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CANE SUGAR AND HEART DISEASE

ARTHUR GOULSTON

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CANE SUGAR AND HEART DISEASE

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CANE SUGAR AND HEART DISEASE

BY

ARTHUR GOULSTON, M.A., M.D. CANTAB.

HUNTERIAN SOCIETY'S MEDALLIST, 1912

PAUL B. HOEBER

67 & 69, EAST 59TH STREET

NEW YORK

1915

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TO

MY FRIEND AND FORMER PATIENT,

H. M. ROSS,

THIS LITTLE BOOK IS DEDICATED

IN GRATEFUL RECOGNITION OF THE ENCOURAGEMENT AND

SUPPORT HE HAS GIVEN TO ME IN MY WORK.

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PREFACE.

THE success which I have had in the treatment of heart disease by means of cane sugar; the fact that, largely as the result of this success, the treatment is being adopted by many of my professional brethren; and, lastly, the numerous inquiries which I continue to receive from all parts of the world concerning the treatment, encourage me to publish this little work.

Craving the indulgence of my readers for its literary defects, I submit it with diffidence to the judgment of the medical world in the hope that it may lead to the more general examination and application of a system of treatment which, in its present admittedly imperfect state, has been so beneficial.

ARTHUR GOULSTON.

HEAVITREE,
EXETER.
July, 1914.

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CANE SUGAR AND HEART DISEASE

CHAPTER I.

DEGENERATION OF THE MYOCARDIUM.

It is now thirteen years since I first began to study what I then called the failing hearts of old age, with their intermittent, irregular, feeble pulses, associated with loss of flesh in the patients.

The hearts of many of my patients presented obscure murmurs, which seemed to vary with their state of health. These murmurs caused me much difficulty in prescribing suitable drugs, and, in spite of all my care, the treatment did not seem to do much good. At last I came to the conclusion that it was not so much the valves which were at fault as the feeble contractions of the heart; so I set to work to ascertain how the musculature of the heart could be improved. A case which I saw in a hospital out-patient department in the eighties, when I was a student, made a great impression upon me at the time, because in those days we were apt to think that a patient suffering from extreme mitral disease was doomed. The case was that of a man of sixty years of age, who had been a "navvy" all

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his life, was still working as a "navvy," and who said that he could do as good a day's work as any man. In examining his heart I noticed a loud systolic murmur, and mentioning this to him, he said: "Oh, I know all about that. I have had it ever since I was seventeen years of age, after having had rheumatic fever. The doctors have all told me that I have it, but it never bothers me." Now, it struck me that, as this man had such severe valvular disease, there must be something which was counteracting the ill-effects of the valvular trouble. This could only be muscular compensation and, as long as the musculature of the heart remained healthy and sufficient, he would not suffer any ill-effects from the valvular fault. So, having this case in my mind, I assumed that the ill-effects observable in the old, irregular, feeble, dilated hearts of my patients might be due to a loss of power in the heart muscle itself.

Again, I understood that the men of the German Army carried sugar as well as first-aid dressings with them, and that, in case of unexpected movements where the commissariat failed, they could undergo considerable muscular exertion on the sugar alone.

Also, I knew that Alpine climbers find sugar most sustaining under the severe strain (heart) of climbing.

These facts, in addition to my physiological knowledge, were in my mind when I first adopted the sugar treatment about thirteen years ago, in a case which did not respond to drugs. As a forlorn hope, I thought I would try the sugar. I selected an absolutely pure cane sugar for the purpose. The treatment was entirely successful,

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as will be seen on reference to the case in Appendix I., Case 1.

This case being so satisfactory, I then began to work out the physiology of the subject in order to see how far my clinical acumen was justified by physiological experiment. Of course the giving of sugar is not original, but *the giving it for the specific purpose of nourishing the musculature of the heart is original.*

My object was to find out whether the physiologists supported me in my clinical observation that *the ingestion of cane sugar has a specific action on the nutrition of the musculature of the heart.*

Since that time I have carefully studied everything bearing on my subject and, in support of my view that it is the musculature of the heart which is at fault in these old, irregular, feeble, dilated hearts, the following pages have been written.

Heart Failure.

Under this heading I shall show that the heart failure in the great majority of cases is due to failure of the *musculature* of the heart to perform its function in an efficient manner.

But before dealing with this vitally important matter of the musculature of the heart with regard to heart failure, it may be well to indicate briefly how this weakened state of the musculature shows itself in the failing hearts of elderly people. These elderly people complain of breathlessness on exertion, their pulses are irregular and intermittent, and though they get along pretty well, provided

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they live calm, quiet lives, they have so little reserve force that some trifling illness from which ordinary folk would recover in a few days proves fatal. Now, these old people die of heart-muscle failure, and although they present heart murmurs of various and varying characteristics, it is the heart-muscle failure which finally carries them off.

Now let us see what are some of the causes of this heart failure. Any disturbance or obstruction of the circulatory system is certain to cause embarrassment of the heart sooner or later.

Valves.—Dr. J. Mackenzie* says: "Patients have died, and the diagnoses have been verified, for the suspected valves have been found shrunken, and the cause of death has been duly certified as disease of the valves." I quote this in order to show the way in which many medical men still regard valvular diseases of the heart—namely, as THE cause of death in heart cases with valvular lesions.† Now, I regard the valvular trouble not as the cause of death, but as the cause of heart-muscle failure. It is this latter which is the final cause of death, and therefore the one we have to treat—that is to say, we have to try and postpone the onset of heart-muscle failure as long as we possibly can.

The cause of the heart-muscle failure in these cases is the obstruction or disturbance of the circulatory system, which, by increasing the work of the heart muscle, ulti-

* Oliver-Sharpey Lectures, *British Medical Journal*, April 8, 1911.

† I need hardly say that this is not Dr. J. Mackenzie's own view. —A. G.

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mately weakens it, and induces that important phenomenon known as "auricular fibrillation"; and this again, producing fibrillation of the ventricle, brings about the death of the patient. Therefore, the value of the recognition of a valvular trouble by the physician is, in a great number of cases, a classical one, and not of the great importance put upon it hitherto.

High Blood-Pressure and Arterio-Sclerosis.—These must be regarded as causes of mechanical obstruction to the heart, and so causes of the train of events above described. In arterio-sclerosis the heart doubtless is affected by the same degeneration which is causing the arterio-sclerosis, but from the arterial point of view the sclerosis must be regarded as an obstruction and therefore a hindrance to the due performance of the circulatory mechanism.

Malnutrition of the Heart Muscle.—This is a very common cause of heart-muscle failure in a much larger number of heart failures than has been suspected hitherto.

Degeneration of the Heart Muscle.—In valvular lesions, the result of endocarditis, the trouble is not limited to the endocardium, but affects the underlying muscle. This is, no doubt, the cause of the valvular and heart troubles resulting from attacks of acute rheumatism, scarlatina, etc., where the endocardium has been affected.

In the foregoing remarks I have endeavoured to show that it is the heart muscle with which we have to deal when we want to treat heart troubles. Now, failure of the heart muscle is, in the great majority of cases, accompanied by that manifestation of the state of the heart muscle known as "auricular fibrillation." What is auric-

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ular fibrillation? It is thus described: "The walls of the auricle stand in the diastolic position; the systole, either partial or complete, is never accomplished. The wall as a whole is stationary, but careful examination of the muscle reveals an extremely active condition; it appears to be alive with movement: rapid, minute, and constant twitching, or undulatory movements, are observed in a multitude of small areas upon its surface."* The importance of recognizing this condition—*i.e.*, auricular fibrillation—is of the utmost importance, since no less than 60 to 70 per cent.† of severe cases of heart trouble associated with breathlessness and anasarca are due to fibrillation of the auricle. Into the means by which its presence is detected it is not my province to go in this work; but for the benefit of those who are only able to afford the time to take ordinary tracings of the radial pulse, I have reproduced (in Appendix II.) a few radial tracings of various forms of heart disorder successfully treated by the ingestion of cane sugar.

I should like to say here that it is in cases of auricular fibrillation that the ingestion of cane sugar is so beneficial in its effects.

Now as to the causes of auricular fibrillation with its train of sequelæ. One of the chief causes is malnutrition of the musculature of the heart, and this malnutrition takes the form—in a very large proportion of cases—of a lack of dextrose and lævulose for the formation of that

* Dr. T. Lewis, "Clinical Disorders of the Heart-Beat," p. 71, quoted by Dr. J. Mackenzie.

† Dr. T. Lewis, *British Medical Journal*, July 13, 1912.

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store of glycogen in the musculature of the heart which is absolutely necessary to it for the proper performance of its function. Specific poisons—*e.g.*, rheumatic or scarlet fevers, etc.—may cause fibrillation of the auricle. Sudden strains may bring it on, as in Case 4, Appendix I.

Now, it may be said that I have dealt with the all-importance of the musculature of the heart at unnecessary length; but the more experience I have, the more am I convinced that there is often a failure to appreciate exactly what is occurring in cases of heart disease presenting valvular murmurs. This lack of appreciation, as Dr. J. Mackenzie says,* is due to the way in which we were taught our clinical medicine; but whether this be so or not, it is the reason why I have endeavoured to emphasize the part played by degeneration or faulty nutrition of the musculature of the heart in the causation of a large proportion of the sequelæ of heart troubles; for, unless this is recognized, it will be impossible for my readers to follow the rationale of the treatment of disorders of the heart by means of the ingestion of cane sugar, which is the object for which this little book has been written.

* Oliver-Sharpey Lectures, *British Medical Journal*, April 8, 1911.

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CHAPTER II.

PHYSIOLOGY OF CANE SUGAR IN RELATION TO HEART MUSCLE.

SPEAKING of muscle generally, it is quite certain that the carbohydrates play a very important rôle in its nourishment, because there can be no doubt that the carbohydrate introduced into the body as food does become part of the proteid molecule—*i.e.*, of the muscle. I emphasize this point because it is only fairly recently that it has been established. Previously, the prevalent view was that the nourishment of muscle could only be brought about by the ingestion of proteid material; but this idea was erroneous, and it is now quite certain that the carbohydrates are capable of being assimilated by the muscle cell as well as the proteids. Healthy, well-nourished muscle requires glycogen for the due performance of its function—*i.e.*, the glycogen is necessary for the wants of the muscle cells, and also for muscular work. The glycogen of a muscle disappears in direct proportion to the amount of work done by the muscles, and in continued heavy muscular exertion the whole of the glycogen stored up in the body may be used up.*

Now, this stored-up glycogen of the muscular tissues

* W. H. Howell, "A Textbook of Physiology for Medical Students and Physicians," p. 62.

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is first reconverted into dextrose by means of the action of Nasse's ferment, and is then used for the production of muscular energy. The importance of this store of glycogen in the muscles is striking when one thinks of the amount of the stored-up glycogen to the weight of the muscle. This amount of stored-up glycogen, in *resting*, well-nourished muscle, varies between 0·5 and 0·9 per cent. of the weight of the muscle.

Having laid great stress on the part played by glycogen in the nutrition and function of muscle, I will now briefly describe its origin and formation.

The source of the glycogen is the ingested carbohydrate food. For my purpose I shall limit myself to following the course of one member of the carbohydrates (cane sugar) from its ingestion to its storage in the muscular tissues as glycogen. Some physiologists think that all cane sugar is inverted in the stomach and absorbed as fast as it is inverted; but most authorities agree that, at all events, the greater part of the ingested cane sugar is inverted in the small intestine, either by the intestinal invertase or by the inverting action of the epithelial cells of the mucous membrane of the small intestine. This inversion, whenever it takes place, splits the cane sugar into one molecule of dextrose (*d*-glucose), and one of lævulose (*d*-fructose).

I would here mention a most important fact which should be borne in mind by those whose first objection to the cane-sugar treatment is that it will cause flatulent dyspepsia, etc. According to Abderhalden,* the lactic-acid

* Abderhalden, "Physiological Chemistry," Lecture XX.

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ferment of the intestine attacks all the simple hexoses and pentoses, but not cane sugar or milk sugar.

The invert sugar is now carried to the blood-stream by two routes—one by the capillaries of the villus passing through the liver; the other by the lacteals and abdominal lymphatics to the thoracic duct, and so into the subclavian vein.

We have now got our invert sugar into the general circulation, and presented to the tissues for their nourishment; to the heart muscle, as well as to the tissues generally. The dextrose and lævulose thus brought to the muscles are converted into glycogen for their future use. It is thought that all invert sugar brought to the muscles is first converted into glycogen before being reconverted* into the dextrose necessary for their activity (function).

Up to this point we have been dealing with the nutrition of muscles in general, but we shall now turn to the nutrition of heart muscle in particular.

In order to prove the nutritive value of dextrose for the heart muscle, I will describe as briefly as possible the classical experiment of F. S. Locke and O. Rosenheim.†

An excised rabbit's heart was set up in the Langendorf aorta apparatus, and perfused with Ringer-Locke solution (containing dextrose). The perfusion was stopped late each afternoon, and resumed about 9 to 10 o'clock each morning. Although the heart was apparently dead, on resumption of perfusion with the Ringer-Locke

* W. H. Howell, "Textbook of Physiology for Students and Physicians," p. 62.

† *Zentralblatt für Physiologie*, December 30, 1905, No. 20.

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solution (containing dextrose) it gradually, after a few preliminary flickers of the auricles, started beating regularly again, and went on throughout the day—the perfusion, of course, going on all the time. This went on for ninety-five hours, or, practically, four whole days, when the constitution of the perfusion fluid was changed, causing the heart to cease beating.

This experiment is now carried out in all physiological laboratories for educational purposes. The wonder of to-day becomes the commonplace of to-morrow; but though of daily performance, the educational value of this experiment cannot be overestimated.

Now, the sustaining effect on the excised mammalian heart cannot be obtained by perfusing any other sugar except lævulose,* which, however, has a similar effect on the heart, but much less marked than that of dextrose. Now, in the perfusion experiments, it is possible that an actual disappearance of dextrose from the perfused solution takes place.† The disappearance of the dextrose is not brought about by any fermentative process. There is no storing up of dextrose in the form of glycogen sufficient to account for the disappearance of dextrose from the solution after perfusion. Finally, the disappearance of the dextrose is due to the physiological action of the heart muscle during its activity, and is similar to its action on dextrose in the intact organism.

The above physiological considerations bring me to the

* F. S. Locke and O. Rosenheim (from the Physiological Laboratory, King's College, London), "The Consumption of Dextrose by Mammalian Cardiac Muscle."

† *Ibid.*

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conclusion that dextrose—and, in a lesser degree, lævulose —is necessary for the nutrition and functioning of the heart.

While I am on the subject of glycogen, I must mention what many physiologists have noticed—viz., that both in the sino-auricular node and the auriculo-ventricular bundle and its connections there is a remarkable amount of glycogen. Thus, it will be seen that the whole of the musculature of the heart—nerves as well as muscle—presents a large glycogen content. Now, we learn from F. S. Locke's experiment that dextrose plays a most essential part in the nutrition of the heart muscle. Can we not reason by analogy, and assume that the glycogen of the sino-auricular node and the auriculo-ventricular bundle and its connections plays an important rôle in their nutrition and functioning? Further, is it not probable that faulty conduction of these structures may be due to diminished glycogen content? And, lastly, is it unreasonable to hope that an increased supply of dextrose may increase the functional capability of the node and bundle by increasing their glycogen content?

According to Carey Coombs, the writer of the article on heart block in the *Medical Annual* for 1914, there is very little to be done in the way of treatment. The frequent cause of heart block is some interruption in the course of the auriculo-ventricular bundle. But cases of heart block are reported in which most careful examination failed to disclose any lesion of the bundle or nervous system.

Unfortunately for me, cases of heart block have not

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come my way; but when they do, I shall certainly act on the suggestions I have made above.

Dr. B. S. Oppenheimer of New York kindly sent me a reprint of his (in association with Dr. H. B. Williams) paper published in the Proceedings of the Society for Experimental Biology and Medicine, 1913, vol. x., pp. 86-87. The paper is on "Heart Block without Anatomical Lesion," and in it he says: "Complete heart block without anatomical lesion in the auriculo-ventricular system may possibly be of neurogenic or of circulatory origin."

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CHAPTER III.

TREATMENT.

CONCERNING the use of cane sugar as an aid in the treatment of heart disease, there are a few points which I think may interest my reader.

In the first place, my experience is that the best kind of sugar is one which is obtained from the sugar-cane.

There is a great variety of cane sugars, but I have had practical experience of only three kinds—viz., Glebe granulated cane sugar, brown Barbadoes, and East Indian sugar. All these three cane sugars answer well, but some patients seem to think one better than another in their particular cases. It is necessary to avoid *beet* sugar, and the reasons for doing so are given in my paper, read at the British Medical Association Annual Meeting at Liverpool, July, 1912, which will be found in Appendix III., B.

At present I have not been able to obtain ripe sugar-cane in this country, but for a long time I have been trying to get some sent over. My reason for this is that I think the nearer we get to the sugar-cane the more activator we shall get.*

* *Vide* Appendix III., B.

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Amount of Cane Sugar given Daily.

As a rule I start with 2 ounces daily for the first week, increasing the quantity to 3 ounces daily the second week, and to 4 ounces daily the third week. Afterwards I keep the patient to 4 ounces daily, unless some special feature of the case should suggest an increase in the quantity.

I would here draw attention to the statement that the heart requires its own weight of sugar daily for its nourishment.* Now, the mean weight of the adult human heart is from 9 to 10 ounces; therefore we have a wide range of daily dose of the cane sugar. Occasionally I have failed to obtain the effect of the sugar until 6 ounces were given. In the *Medical Annual*, 1914, p. 283, a case is quoted where as much as 8 ounces were given in the twenty-four hours with a "surprisingly successful" result.

But as a rule with these large quantities of sugar there is danger of most distressing vomiting. I advise my patients to take the sugar in small quantities throughout the day. My object in this is to make the quantity seized by the liver —the great storehouse of glycogen—as small as possible.

Diuretics.—I think it is of the utmost importance that, in every case of heart disease, the amount of urine passed in twenty-four hours should be measured. I always insist on having the twenty-four hourly amount of urine determined, and I am sure that this routine has saved me from many pitfalls and caused me many surprises. Of course, in hospital practice this would always be done; but, alas!

* Professor Dr. Albert Adamkiewiez, *Prager Medizinische Wochenschrift*, No. 43, p. 601.

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I have not had the advantages of hospital practice. If the amount of urine passed is sufficient, well and good; but if it is deficient in quantity, one must look out for œdema and ascites, and use diuretics with discretion. In a certain proportion of cases the taking of cane sugar is sufficient to produce an increase in the daily amount of urine passed without the aid of diuretics. Appropriate diuretics will be well known to my readers, but let me sound a note of warning with regard to Bailey's Pill (squill, digitalis, mercury), as so many of my heart cases have had bad teeth. Indeed, so much is this the case (bad teeth) that I suggest there may be some connection between the bad teeth and the heart trouble, the former being an indirect contributory cause of the latter.

While on the subject of the urine, I should mention the fact that in all my cases, running into hundreds, I have rarely found even a trace of sugar in the urine, with Fehling, although many of the patients were taking large quantities of the cane sugar daily for many months.

Rest.—In cases with extreme dyspnœa on slight exertion, complete rest must be insisted upon for a time, but as the heart improves, gentle walking on the level is doubtless beneficial.

Diet. — This should be plain, strictly moderate in amount, and chiefly farinaceous. The amount of liquid consumed in the form of tea, coffee, milk, etc., should be reduced to the minimum, and, if possible, should not exceed 2 to 2½ pints in the twenty-four hours. Into the question of whether rich soups, sauces, entrées, etc., should be forbidden, I do not propose to enter, because no

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sane medical man would be in the slightest doubt for one moment.

Alcohol.—Total abstinence should be the rule, but in fainting attacks a very small amount of the best brandy may be given to stimulate the heart temporarily. On no account should alcohol of any kind be allowed as a beverage, nor any so-called malt liquor, which includes all the beers, stouts, ales, porters, etc.; in fact, as little fluid as possible should be taken. The only exception I make is Plymouth gin (Coates's), which may be given well diluted as a diuretic; but here, too, I think it better to rely on drugs to increase the flow of urine where this is not effected by the sugar alone.

Mode of giving the Sugar.—The daily quantity should be dissolved in hot—not boiling—water, and taken in good sips throughout the day—say every two hours. If the daily amount to be taken is large, half may be taken in solution and the remainder with milk, milk puddings, stewed fruit, tea, coffee, cocoa, etc., or spread on bread-and-butter.

It is not desirable to take sharp acids, such as vinegar, lemons, nor effervescing fluids, while taking the sugar.

If the patient nauseates at the solution of sugar, the repugnance to it may be overcome by adding some essence of ginger, grated ginger, or other flavouring. But I have not yet had a patient who so disliked the sugar as not to be able to overcome his dislike in a week or two if the treatment was begun with small and gradually increasing quantities.

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Some medical men have raised the objection that the sugar will produce uric acid, and on this account it is not desirable to give the sugar in rheumatic or gouty subjects. I have never had any trouble in this way, although some of my patients have been taking from 2 to 3 ounces daily for over twelve years. As regards gout, I have yet to learn the connection between gout and cane sugar.

Selection of Cases.

Auricular Fibrillation.—These cases answer well to the treatment as a rule, and as—according to Dr. James Mackenzie and Dr. Thomas Lewis—they constitute about 70 per cent. of the cases of severe heart failure with dyspnœa and dropsy met with in general practice, the range for the usefulness of the treatment is considerable.

Auricular Tachycardia. — The few cases of this form of heart trouble which have come under my notice have done extremely well as a result of the treatment.

Valvular Lesions after Acute Rheumatism.—We know that a very great many persons suffering from severe mitral disease live to a good age without experiencing much inconvenience; but as a rule there comes a time when the heart muscle begins to fail, and the usual train of symptoms develops. These cases do extremely well under the cane-sugar treatment.

Angina Pectoris.—In true angina the treatment has proved a complete failure, and had to be abandoned. There are, however, a number of cases suffering with pains across the chest and down the arms (especially the

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left) which have been diagnosed as angina, but which, on more careful examination, turn out to be ordinary cases of auricular fibrillation. These cases do well under the treatment. Recently I had a case which was diagnosed as angina pectoris by a great authority on the heart. I had a look at the chest through the "screen," and found an aneurism of the aorta.

Tobacco Heart.—The few cases I have had, have done well; but it must be remembered that I was successful in persuading my patients to give up smoking entirely. This latter is, of course, the crux of the treatment. Still, I think that the sugar was of great assistance.

To sum up, my cane-sugar treatment is of great value in any case where there is reason to believe that the musculature of the heart is failing. Bearing this statement in mind, it will be seen what a wide field there is for the intelligent use of the treatment of heart troubles by means of the ingestion of cane sugar, not only alone, but also in conjunction with the ordinary cardiac pharmacopœa.

At this point I do not think it will come amiss if I say a few words about the consumption of sugar in general. Seeing the enormous quantity of sugar consumed in this country in the form of sweetmeats alone, I think it is a matter of the utmost importance that they should be made from cane sugar instead of from beet sugar. I advocate this as a means of combating the heart-muscle failure, which is increasing by leaps and bounds. Some few more remarks on this subject will be found in Appendix III., D.

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URINE.

Although my patients take such large quantities of cane sugar, I have never detected sugar in the urine with Fehling's solution; and this is the experience of medical men who make use of my treatment.

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APPENDIX I.

TWENTY REPRESENTATIVE AND CHARACTERISTIC CASES SELECTED FROM A LARGE NUMBER (RUNNING INTO THE HUNDREDS) SUCCESSFULLY TREATED BY MEANS OF CANE SUGAR.

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ILLUSTRATIVE CASES.

Case I.

(This case appeared in the *Phonographic Record of Clinical Teaching and Medical Science*, vol. xiv., No. 4, August, 1908.)

"A Note on the Treatment of the Intermittent, Irregular, Feeble Heart of Old Age. By A. Goulston.—I have come across a good many cases of intermittent, irregular, feeble hearts in elderly people, who were apparently healthy in every other respect, and in which alcohol was the only thing which did any real good in steadying the heart. Unfortunately, the amount of alcohol for this purpose had to be gradually increased until the amount consumed became an almost greater source of trouble than the disease itself. Four or five years ago, having such a case on my hands, I thought that sugar might possibly take the place of alcohol. . . . A lady, seventy-four years of age, whom I have attended off and on for eighteen years, has been a very healthy woman, and had very little illness during her life.

"In 1904 she began to complain of 'fluttering of the heart,' which made her feel nervous. The pulse was rapid, irregular, and intermittent, but there was no organic disease of the heart. She became extremely ill, and for the sake of the relatives I had a second opinion.

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She was put on the approved drugs, but the heart did not steady itself unless she took considerable quantities of alcohol. I gave up drugs and kept to the alcohol, but this had to be increased so much that I determined to try the sugar. The patient disliked alcohol, and consequently I had no difficulty in persuading her to reduce the alcohol and take the sugar. I put her on 3 ounces a day, and gradually reduced the alcohol by half an ounce a day until she ceased to take any at all. The heart remained steady under the sugar, and is so at the present time. This patient could not travel nor even walk, and at one time we kept her on the same level in the house; but the last two or three years she has travelled all over England during the summer months, paying visits to her friends."

Her heart was quite regular and steady in November, 1911. It need hardly be said that she does not take 4 ounces of cane sugar daily now. I kept her on the sugar until she was obviously putting on flesh; I then reduced it gradually, until she gave it up entirely. During the last three or four years she resumed her sugar when she felt her heart was "wrong," and took it for a month or so, and then left it off. Since her heart recovered she has been perfectly well.

March 16, 1914.—She is now close on eighty-four years of age. She is quite well, and walks out daily, and last summer she paid her usual round of visits, travelling alone.

Comments on Case 1.

One fact about this case is the failure of the recognized heart drugs to steady the irregularities of the heart;

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another is the beneficial effect of alcohol as long as the dose was being increased; the third, and most important for my purpose, is that the cane sugar was successfully substituted for the alcohol.

Another interesting fact is that when the patient—after having taken cane sugar for some years—took beet sugar, the heart began to fail again, but resumed its normal action when the patient was once more put on an allowance of cane sugar. This latter is most important in connection with the few words I shall have to say in Appendix III., D., on the subject of prophylaxis in relation to heart disease.

Another matter worth mentioning is the extraordinary good health enjoyed by the patient, who, though now nearly eighty-four years of age, walks out daily, and works hard at fancy-work for charities.

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CASE 2.

(Given me by Dr. Herbert G. Cook of Cardiff.)

On May 4, 1913, Dr. Cook wrote me as follows:

"A man of about fifty-four years of age, of strictly orderly and temperate habits, had for three years (before I knew him) suffered from fainting attacks, usually on rising in the morning. I found that he had an intermittent pulse, often dropping four or five beats at the wrist, and during these periods the heart sounds would be inaudible. I never saw him at his worst, owing to the time at which the attacks occurred; but his wife, who became an expert at watching him, has assured me that his pulse would be impalpable during a period equal to twelve or fifteen beats when he was very bad, and then he would almost lose consciousness, and he always looked 'ghastly.' As soon as the pulse returned he flushed up. Usually by the time I saw him his pulse was quite steady and easy-going, but I have at times found it intermittent, as I mentioned. Bromides were the only drugs that seemed to do any good. When seen by a well-known authority on heart diseases his heart was perfectly quiet and regular, and no tracing would have shown anything abnormal. Fortunately, when he went to see Dr. James Mackenzie, his pulse was intermittent, and the polygraph tracings (reproduced) showed auricular tachycardia. Someone, I do not know who, suggested to my patient

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that he should try brown West Indian sugar about Christmas last, which he did, with the result that he has been quite free from attacks since. I may say that his vessels are healthy, and his blood-pressure has always been low—about 130 mm. Hg."

On January 28, 1914, Dr. Cook wrote me as follows:

"Though some intestinal product was suspected at first, it is certain that the treatment directed to the bowels (*e.g.*, calomel and mild purgatives) had no lasting effect, and it was only when the sugar was taken that the real improvement occurred."

March 5, 1914.—Dr. Cook writes: "It might be useful to mention that the patient always had a foul breath and coated tongue, and that his stomach was splashy, indicating that he had some dilatation or atony, and that his urine habitually contained crystals of uric acid."

The following account is an abstract of a letter sent to me by the patient's wife on January 8, 1914:

"For a long time the patient had complained of palpitation and giddiness, and in July, 1911, he had bad fainting attacks after rising in the morning, and would have many while dressing. He was much better in the spring of 1912. He was worse again in the autumn, and then saw specialists in London. October, November, and December, were his worst months. About December, he heard of the cane-sugar treatment, and tried it. Since December 23, 1912, he has not had a single attack of fainting, but the giddiness did not go off entirely; for

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when he left off taking the sugar for a month in the summer (1913) the giddy attacks came on again, but no faintings, and the heart got very uncomfortable. He resumed the taking of the sugar, and has been well ever since, and can follow his ordinary occupation."

Comments on Case 2.

Of this case the striking features are the absolute certainty of the diagnosis and the hopeless prognosis. Another is the rapidity with which the patient improved, for, after about fourteen days of the cane-sugar treatment, he ceased to have fainting attacks. A noticeable point, too, is the fact that brown Barbadoes sugar was the sugar taken.

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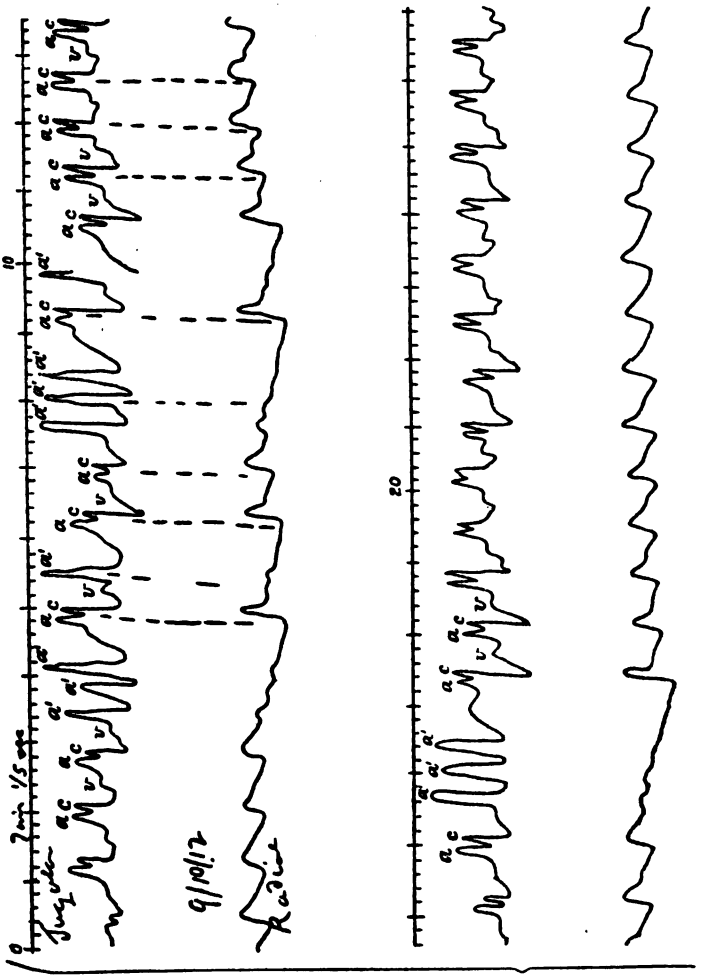

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POLYGRAPH TRACING OF CASE 2, TAKEN BY DR. J. MACKENZIE.

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Case 3.

(Given me by Dr. A. H. Carter of Wolverhampton. This case has been published in the *British Medical Journal*, November 25, 1911, since it was given to me.)

"A lady, aged sixty-two years, always in good and vigorous health, except for fibroid trouble fifteen or twenty years ago, which was cured (?) by 'epistolary treatment.'

"Two years ago (in 1909) she began to fail, and felt unequal to the active life to which she had been accustomed. She had been in the habit of spending the winter months in indulging in all sorts of sports—deer-stalking, etc.—things entailing much exertion and requiring considerable physical strength. But for the last two winters she found herself unable to walk and keep up with the rest as before. Then, in the March of 1910 she had a bad influenza cold, the effects of which she seemed unable to thoroughly throw off; and soon after she began to go out again, when walking one day she fell, spraining her ankle. She has no recollection of tripping over anything, and cannot in any way explain her falling. For this sprain she was on a sofa for about five weeks, and then began to go out again; but she felt utterly unfit for exertion. She lost weight, and had an evening temperature of 101° F. I saw her early in July of 1910. Temperature 100° F.; quick, feeble pulse, 120. Heart sounds feeble, fœtal rather in character. I formed the opinion that she

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was suffering from myocardial degeneration aggravated by influenza. The poison of it she had not properly thrown off. The impulse was one inch outside the nipple-line; a systolic bruit over the aortic area; but none—or so slight as to be negligible—at the apex. No œdema and no albuminuria. Her colour was greyish, and very slight exertion made this worse still. She felt utterly unfit for anything mental or physical, and, as she explained, she felt more inclined to lie down and die than anything else. She was made to spend most of her time in the open, resting in the garden. She had previously hardly ever had open windows, and after lighting-up time, she had burned far too much gas in closed-up rooms. Her temperature very soon reached normal; never rose above normal again. She went to Scarborough for two months, carrying out her rest and fresh-air treatment there. Meantime, she took a little strophanthus, strychnine, arsenic by turns. But the pulse-rate, until some time after her return home from Scarborough, was never, even when in bed, under about 110 to 120.

"During October, November, and December, she still spent most of her time out of doors, or, muffled up in wraps, sitting at the open front-door or open window, and her improvement was considerable—her pulse-rate came down to about 90. Still, she never felt equal to any exertion, and she had no mental nor physical vigour. She spent January and February (1911) at Hastings with the same fresh-air and resting treatment.

"In October her blood-pressure was found by a specialist to be 170 mm. Hg; but I never found it so

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high again, and it quickly came down and stayed at about 136 mm. Hg.

"After Hastings her condition was much the same as before—a trifle better, perhaps, but still no real feeling of energy or vigour.

"I took her early in March (1911) to see Sir Lauder Brunton. His opinion confirmed mine—that she had about reached as good a state of health as she could expect. I principally took her to see him with a view to asking him if he thought Nauheim would suit her. He thought it would, but did not seem to think that *much* improvement was likely, or even possible. He found a mitral systolic bruit as well as an aortic systolic; he otherwise confirmed my opinion of her. Her pulse-rate was about 80 to 90.

"Arrangements were made for her to go to Nauheim in the beginning of June, 1911.

"Early in April I thought I would try her on your sugar treatment, and after writing to you on this subject, as you will remember, I began, as you suggested, with 2 ounces of the Glebe Granulated Sugar daily (she had been a person who practically never took any sugar previously—taking it in neither tea nor coffee, and having her puddings and fruit-tarts made *without* sugar).

"For the first week she took 2 ounces daily; for the second, 3 ounces daily; for the third, 3 ounces daily; and for the fourth, 4 ounces daily. She found, by avoiding soups, gravies, pastries, fruits, etc., that she never got any flatulence, and she took the sugar in her tea and coffee, and spread upon dry bread. After the third week she

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felt immensely improved, and after four or five weeks, better still. She regained her old mental and physical vigour, and whereas she could not walk (before the sugar) for more than half a mile, after four weeks of it she could walk between two and three miles almost without fatigue. If she felt she wanted a rest, she was refreshed in a few minutes. She took no medicine during the time, nor, indeed, had she taken any all this year, except pot. iod., gr. v., bis in die. She slept better, and vague rheumatic and neuritic pains, from which she had long suffered, quite disappeared. Her weight first went up slightly, but has now for some weeks been going down a little.

"She went to Nauheim, because all arrangements had been previously made; otherwise her improvement was such that I should not have considered it necessary. She was under the care of Professor Groedel, and had numerous baths. These invigorated her, and she said she felt better for them; but I cannot say that, since her return, I consider her better in any way than before she went away.

"Sir Lauder Brunton was at Nauheim for treatment, and saw and examined my patient, and wrote to me saying: 'Your patient's improvement is simply miraculous. I can find to-day no murmur *at all* at the apex; there is a slight systolic one over the aorta. Her pulse is 90, quite regular; her tension 125 millimetres.' This was good testimony, wasn't it?"

(*March* 27, 1914.—I have just heard that this patient "has remained perfectly all right, and in quite her ordinary vigorous health, and has lately been to Jerusalem."—A. G.)

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Comments on Case 3.

This is interesting from the fact that there were two possible causes of the fibrillation—viz., the attack of influenza, and the fall. Was this a purely post-influenzal heart failure, or was the fibrillation started by the effect of the fall upon a heart already weakened by the toxic action of the influenzal attack?

It is also worth noting that the ordinary drug treatment and complete rest failed to benefit the patient to any great extent. The testimony of Sir Lauder Brunton should also be noted.

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CASE 4.

(This case has been published in the *British Medical Journal*, January 13, 1912, by Dr. Dingle of Barmouth, who gave it to me.)

W. J., aged twenty-eight, plumber.

First consulted me on December 4, 1910, complaining of great shortness of breath and swelling of the abdomen. The shortness of breath first commenced in July, 1910, and in August he noticed his abdomen getting larger. He became gradually worse, but continued his occupation with difficulty up to the above date.

Past History.—Had always been healthy; had had no previous illnesses or any rheumatism. Always been temperate.

In March, 1910, he was pulling a heavily laden hand-cart up a stiff incline, when he suddenly felt giddy and faint, had difficulty in getting his breath, and had to sit down for a time. After a short rest he continued his work, and thought no more about this incident.

Present Condition (*December* 4, 1910).—Patient looked ill; dusky complexion, anxious expression; had to gasp between his sentences while talking to me. Marked dyspnœa. Abdomen much enlarged, and definite signs of dropsy. Slight œdema of skin over lower part of abdomen; no œdema of legs.

Heart.—Apex-beat diffused, slightly left of nipple-line. No definite bruit heard at apex, but an irregular galloping,

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tumbling sound heard, and intermittent. Aortic sounds normal, except second; slightly accentuated.

Pulse.—100; feeble, irregular, and intermittent.

Lungs.—Normal. Respiration, 35.

Urine.—No albumin. High coloured. Urates.

Liver.—Not enlarged.

Appetite.—Only fairly good.

Tongue.—Clean.

Girth measurement at level of umbilicus, 35½ inches.

I considered his condition of failing heart serious, and that the case was probably due to damage to his mitral valve, produced when pulling the hand-cart the previous March.

I ordered him to remain in bed, absolutely quiet, and put him on a light, nourishing diet, and gave him tinct. digitalis ℥v., tinct. nucis vom. ℥v., every four hours. Also large doses of mag. sulph. every morning.

December 7, 1910.—Condition much the same, though has to be propped up with pillows. Taking nourishment fairly well. Passing 3 pints of urine in twenty-four hours. tinct. digitalis ℥x., tinct. nucis vom. ℥vii. every three hours.

December 12.—Breathing more comfortably, feeling better. Pulse a little steadier, 88. Heart-sounds at apex much the same. Appetite improving. Increased the tinct. digitalis to ℥xii. every four hours. Girth measurement of abdomen, 32 inches.

December 17.—Stopped digitalis for a few days and substituted strophanthus. Urine passed, 4 pints.

December 22.—Continued digitalis ℥xii., tinct. nucis vom.

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mxii., and liq. strychnine miii. every three hours. Calomel, gr. v. occasionally at night. Condition much the same, though sleeping better at night.

December 26.—Condition rather worse; increased amount of fluid in abdomen. Girth measurement, 34 inches; pulse, 88; respiration, 40. Slight œdema at bases of both lungs at back. Passing less urine, 3 pints, very high coloured. No albumin. Stopped digitalis, and put him on diuretics.

December 31.—Condition much the same. Some galloping rhythm heard at apex with faint systolic bruit. Returned to digitalis and strychnine; also large doses of mag. sulph. mornings and occasional large doses of calomel at night. Had a consultation with Dr. Wood, who gave a very bad prognosis.

January 2, 1911.—Discontinued digitalis for a while and gave pot. iod. gr. x. every four hours; also calomel, gr. ½ every three hours.

January 4.—Slightly better; breathing more comfortable; passing rather more urine, 2 quarts. Amount of dropsy much the same. Taking food better.

January 5.—Returned to digitalis as the pot. iod. seemed to disagree. The digitalis was always discontinued for a few days when there was much slowing of the pulse. Condition of the heart much the same. Pulse, if anything, slightly stronger, 75. Urine, 3 pints in twenty-four hours. Has rather a better colour.

February 1.—Condition worse; more fluid in abdomen. Signs of fluid in left pleura; also some pleuritic friction in left axilla, causing some pain. No rise of temperature.

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Unable to lie flat at all. Given elaterin ℿx. with a day or two's rest between.

March 3.—More comfortable, and is lifted out on to couch and wheeled out when weather is fine. Breathing more comfortable and appetite better; certainly improved by being in the fresh air. Condition of the heart much the same.

April 30.—Still taking digitalis, which seems to suit him better than anything else. Bowels kept acting well with mag. sulph. and occasional dose of calomel. Condition of heart much the same. Amount of fluid in abdomen much the same, though that in left pleura less marked.

May 5.—Not so well. Has not been out of bed for a few days. Abdomen increasing in size; œdema of skin of abdomen more marked; breathing more distressed; respiration, 40; pulse weaker, 100. Heart sounds very irregular, and bruit distinct at apex. Appetite bad. Dusky colour.

May 7.—Most uncomfortable, taking very little nourishment. Vomiting at times. Fluid in abdomen much increased. Fluid in both pleuræ at bases at back. Condition appears hopeless. Tapped abdomen, and drew off 11 quarts.

May 8.—Much relieved after tapping, taking food fairly well. Better colour. Pulse, 80; respiration, 30. Heart sound much the same. Able to lie down at night.

May 10.—Wheeled out of doors again, and seems to be improving. Less fluid in left pleura. Continued improvement during this month. Much more comfortable.

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June 2.—Fluid accumulating again in abdomen. Breathing difficult at times, and unable to lie down.

June 11.—Most uncomfortable. Abdomen filled up again; difficult breathing. Heart sounds more feeble with irregular cantering rhythm. More fluid in left side of chest and œdema of both bases. Dusky colour. Tapped, and 8 quarts drawn off.

June 12.—Much more comfortable since fluid of abdomen removed. Condition of heart much the same. Commenced sugar treatment, taking 5 ounces Glebe cane sugar every day, continuing small doses of tinct. digitalis.

June 14-16.—Discontinued all medicine with the exception of occasional aperient. Taking the sugar, feeling of nausea at times. Some days is not able to take the full 5 ounces. Able to be wheeled out in Bath chair again.

June 20.—Feels decidedly better; able to lie down at night; breathing much more comfortable. Pulse a little stronger, but still very irregular and intermittent. Heart sounds much the same. Some fluid in abdomen, but no marked increase. Fluid in left side of chest less. Œdema at bases less marked.

July 2.—Decided improvement in general condition. Able to go out in Bath chair and remain out most days. Much better colour, sleeping well, appetite good. Taking the full 5 ounces sugar regularly, without inconvenience. No increase of fluid detected in abdomen, no signs of fluid in left pleura. Diminished breath sounds at left base. No œdema of lungs.

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August 30.—Still improving. Out every day in Bath chair, and sits upright in chair. Taking the 5 ounces of sugar regularly. Appetite good. Sleeps well. Much better in every way. Scarcely any fluid can be detected in abdomen, and none in chest. Heart sounds more regular. Pulse stronger. Passing 2 quarts of urine.

September 12.—Still improving. Out every day in chair. Would like to try and walk, but I advise him not. Passing normal quantity of urine. No appreciable amount of fluid in abdomen. No œdema of skin of abdomen. Heart sounds slightly less irregular and intermittent. Bruit not always heard. Pulse stronger. Colour good. No fluid in chest. Diminished breath sounds at left base due to thickened pleura. He continued in this condition up to *October* 9, when he had a severe shock on being told that a friend and neighbour of his had been run over by a train and had lost a leg. He experienced difficulty of breathing again, not eating or sleeping well. Pulse weaker, and heart's action feebler. I ordered him to bed for about a week, and put him again on digitalis. He soon improved with the rest, and was able to go out in his Bath chair again on October 16.

October 20.—Much improved, and is now as well as he was before the shock of October 9.

November 29.—Going out every day in chair in which he sits up quite comfortably, and says he feels quite well. Appetite good. Sleeps well. Able always to lie down at night. Passing normal quantity of urine. No shortness of breath. Have not allowed him to walk yet, but he is able to stand. Still taking 5 ounces sugar a day.

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Heart.—No bruit heard. Still the cantering, irregular rhythm at apex. Heart's action considerably stronger. Apex-beat in normal position.

Pulse.—80; small, irregular, and intermittent.

Lungs.—Normal, with the exception of diminished breath sounds at left base due to thickening of pleura.

No œdema or fluid in abdomen.

Notes.—This is evidently a case of failing heart which dates from March, 1910, when he damaged his mitral valve by pulling the hand-cart up the hill. From the time he first came under my care he was treated with all the various cardiac drugs, both in large and small doses, with absolute rest and suitable diet, etc. Though at times he showed signs of improvement, it was never lasting, and he steadily went from bad to worse, until on May 7 he was tapped, and 22 pints of fluid were drawn off from his abdomen. This, of course, improved matters for a while, but he soon began to fill up again, and was tapped four weeks later; this time 16 pints were removed.

Since June 12, 1911, he has taken 5 ounces of sugar a day, hardly missing a single day, and almost always taking the full quantity.

Only twice since June 12 has he taken any cardiac drugs, and then only for a few days, and has never required tapping.

I attribute his remarkably improved condition (his condition at one time appeared absolutely hopeless) solely to the cane sugar. His urine, which was examined on various occasions, never showed any albumin.

Whether in time he will sufficiently improve to allow of

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light work remains to be seen, but I think it well worth while continuing the sugar treatment.

Dr. Wood, who saw the patient twice with me before I commenced the sugar, agreed with me that there was little to be done, as it seemed quite a hopeless case.

I may add that the patient experienced no inconvenience in taking such a large quantity of sugar, except at the very first, when he occasionally had a feeling of nausea.

Comments on Case 4.

Here we have the history—a fairly common one—of sudden severe strain as the cause of the onset of the symptoms. Sudden or severe muscular exertion is so frequently the cause of heart failure that I have brought forward this and other cases to emphasize the fact.

Here, again, all the ordinary means of treatment were tried without effect.

There was undoubtedly fibrillation of the auricle and dilatation of the heart, together with mitral incompetence.

The varied and severe complications render the case of exceptional interest as showing the value of cane sugar in restoring the enfeebled heart muscle to its normal tone.

It is to be noticed that while this patient was under the cane-sugar treatment, he practically did not take any drugs.

Again, I would draw attention to the fact that the last note by Dr. Dingle says, "Apex beat in normal position"; so, presumably, the heart had returned to its normal size. This is of some importance from a controversial point of view.

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Case 5.

A gentleman, seventy-seven years of age, who had been in the habit of taking alcohol freely all his life, had an attack of hæmatemesis. His pulse was large, of high tension, and rapid, and his arteries were atheromatous. I stopped all alcohol for the time, and in a few days his pulse became irregular, intermittent, and feeble. I then found that his heart was dilated, and that there was a systolic murmur to be heard at the base of the heart. The hæmorrhage ceased, and after a few days' interval I let him have small quantities of alcohol. Later on he readily agreed to take the sugar and give up the alcohol. He carried out my instructions to the letter, so that in the course of fourteen days he had gradually worked up to taking 4 ounces of sugar daily. The improvement was most satisfactory, for in about three months his heart steadied down, the murmur was less, the pulse became regular, both in rhythm and volume, and his general health was much improved. As he likes sugar, he went on with it, and has done so up to the present time, although he varies the amount from time to time according to his feelings.

About nine months after commencing the sugar treatment (*i.e.*, May, 1910) he had an attack of acute bronchitis. In addition to the usual treatment, I gave him small

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quantities of sugar, with excellent results, and he recovered after a fortnight's illness.

In July, 1911, he had an attack of severe diarrhœa, which he got over in a few days; but three days afterwards I was sent for in a great hurry, when I found him in a state of mild uræmic coma, and passing only a very small quantity of urine. (I could not succeed in dissuading him from taking cold meat, of which he was fond, for breakfast, dinner — midday — and sometimes in the evening.) He recovered from this attack in the course of a week, and has been in excellent health and spirits up to the present (May, 1912). He had now been taking the sugar for about two years. During the bronchitis, and also during the uræmic attack, his heart remained regular in its action, and I am of the opinion that this was due to the improved condition of the musculature of the heart as the result of taking the sugar for a considerable time.

This patient walks daily to his club in Exeter in all weathers. It is a distance of only a mile and a quarter, but during the walk he has to go over a considerable hill, and he does it at a fair pace and without becoming breathless. He says that he feels better both mentally and physically than he has done for the last seven or eight years; his behaviour and conversation bear out this statement.

March 24, 1912.—He has just recovered from another attack of acute bronchitis. He is now as well as ever, and his intellect is acute and active.

I have tried to think that I must be mistaken, and that

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the "wish is father to the thought"; but I am convinced that his arteries (judging by the fingers on the radial) are quite soft now. I dare not suggest what is in my mind, but I cannot think I am mistaken in my clinical observation.

Comments on Case 5.

This is interesting on account of the minor illnesses, from which he recovered in a most satisfactory manner.

It was in connection with this case that I was advised to publish a short account of my cane-sugar treatment in one of the great medical journals. During one of the minor illnesses I had to call in a consultant, who was very much struck with the excellent state of the heart under adverse circumstances. He asked me to tell him all about it, and he thought so much of it that he urged me to publish my paper in the *British Medical Journal*, March 18, 1911.*

I would also draw attention to the last remarks in this case: I was thinking of atheroma of the vessels.

* *Vide* Appendix III., A.

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Case 6.

A man, sixty-five years of age. About four years ago (in 1908) he called me in because he was not satisfied with the results of the treatment adopted by his medical man, who had been treating him, off and on, for more than a year, for gout, and the patient was getting worse.

When he came to me he was complaining of persistent troublesome cough, breathlessness, and general weakness; and he was much annoyed because of his loss of memory and inability to read for any length of time. His irritability at home was causing his wife and daughter much pain.

His feet and legs were œdematous, and he was passing only about ¾ pint of urine in the twenty-four hours. I could not find anything abnormal in the urine. His heart was acting very feebly, and the apex-beat was outside the nipple-line, and diffuse. In both lungs, at the bases, I heard coarse crepitations, but the rest of the lungs were free from moist sounds.

I tried diuretics, but he did not improve much. I then put him on the cane sugar in the usual way, and also gave him two or three wineglassfuls of Plymouth gin and hot water a day as a diuretic, and also to satisfy his desire for some alcohol. In three weeks there was a decided improvement in all his symptoms; and at the end of four months he was quite well and able to carry on his business

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as usual, and his mental powers returned. The heart's action became good and the pulse quite regular. The hypostatic congestion of the lungs cleared up and the cough ceased.

March 23, 1912.—It is now about four and a half years since I treated this patient. He tells me that he still takes the sugar—but not in such large quantities—because he likes it, and feels it "does him good."

I see him walking about Exeter daily, and he looks well, and I know, from his relations, that he has not required medical assistance since I last attended him.

Comments on Case 6.

This is an ordinary case of auricular fibrillation. I notice that in many of these cases with general anasarca the patients suffer from mental hebetude. Whether this mental hebetude is due to faulty supply of blood to the brain, or to fluid pressure in the lateral ventricles, is one of the questions which the future will answer.

An able medical man had been treating this patient for gout; but if he had gout, the cane-sugar treatment did not aggravate the symtoms—if he had any. I did not notice them.

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Case 7.

A woman, thirty-four years of age. In August, 1910, she was complaining of pain in the chest and shortness of breath. She had suffered with her heart for over twelve years; but latterly she had been getting worse. During May and June, 1909, she was in the National Hospital for Diseases of the Heart, Soho Square, London, and got better, and was fairly well till June, 1910.

She was admitted to the Royal Devon and Exeter Hospital on August 18, 1910, and had been treated there as an in-patient till December 1, without much benefit. On December 1, a friend on the hospital staff kindly handed her over to my care so as to allow me to try my treatment on her. Her heart was enlarged, and there was a systolic murmur heard well at the apex, which is displaced to the left. Her pulse was hardly perceptible at the wrist. She was now put on cane sugar—3 ounces a day. On December 15, she was much better in every respect, and was getting up for an hour in the evening. At that time the improvement was considerable. Her pulse was of fair strength and regular, and the heart bruit was lessening. On January 13, 1911, I made the following note: "She has been getting up every day for dinner, and has remained up till bed-time, and is putting on flesh; her heart is steadying in a marked manner and she has not had any palpitation for a long time."

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February 13, 1911.—Her heart is quite steady, and her pulse quite regular and of good tone. She looks, and is, in excellent health. She left the hospital in order to resume her work.

January 10, 1912.—A Sister in the Devon and Exeter Hospital told me that she had just heard from this patient, and that she (the patient) was quite well.

March 19, 1914.—A few weeks ago a nurse told me that she had heard of this patient again, and that she was still keeping fit.

Comments on Case 7.

It is to be noted that we have knowledge of the fact that she was still keeping well three years after treatment. This is interesting, because it is only occasionally that I hear anything of patients after they improve.

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CASE 8.

A woman, thirty-two years of age. In 1908 she was complaining of frequent "dead" faintings almost daily, impossibility of walking, coldness of feet and hands. About 1896 she had been treated for heart trouble at the dispensary, and improved slightly.

There is a history of rheumatic fever.

Now (June, 1908) she has lividity of the face, feet, and hands, and the feet are cold and clammy. There is a loud rasping systolic murmur heard at the apex of the heart and out into the axillary line. The apex is about an inch below and to the left of the nipple-line. The heart is acting very rapidly, and with apparent strength; but the pulse is hardly perceptible and quite uncountable. I did not find anything to remark upon in any other organ.

I kept her in bed for some weeks, and put her on cane sugar—4 ounces a day, and finally went up to 6 ounces. In this case I was obliged to give digitalis and iron. She went on in this way, steadily improving, for nine months, when she gave up the medicine and only took the sugar. In November, 1910, her heart was perfectly steady and acting quite normally. The pulse was regular, both in rhythm and volume, and of good tension. She tells me that she can walk about five or six miles over our Exeter hills without any uncomfortable sensations, although she has to moderate her pace uphill. She still

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takes the sugar when she feels she wants it. She is putting on flesh.

February, 1912.—She is still quite well, but she has to take the sugar from time to time when she feels a little breathless.

April 24, 1914.—I spoke to this patient to-day and asked her how she was. Her reply was: "Splendid! But, mind you, I have to take the sugar. I have tried to give it up for three weeks, but I soon began to feel it, so I had to resume taking it." She can walk as well as ever.

Comments on Case 8.

The point here is that, in those early days, I did not dare to trust to the sugar treatment alone, so for some months I kept her heart steady with digitalis, giving the cane sugar at the same time.

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Case 9.

A woman, thirty-five years of age. Married, with three children. I was called in early in 1909. There is a strong family history of tubercular phthisis. She was complaining of loss of flesh and worrying cough. There was consolidation of the apex of the right lung. The expectoration was slight; but she had lost, and was losing, flesh rapidly.

With regard to the heart, it presented the usual symptoms of dilatation, and there was a faint systolic bruit to be heard at the apex.

These were the symptoms when I put her on the sugar treatment, together with Easton's syrup. In six months she had put on flesh to such an extent that she stopped the sugar for a time.

December 29, 1910.—The pulse was quite regular and of good volume, and the heart did not present any signs of dilatation. For the last nine months she has been very well. The cough is very slight, and she eats and sleeps well.

March 22, 1912.—This patient is now in rude health. I have seen her run a good hundred yards in order to catch the tram, and she was only slightly out of breath when she got into it.

March, 1914.—This patient still keeps well.

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Comments on Case 9.

This case is interesting on account of the strong family history of tubercular phthisis and the state of the apex of the right lung.

I would emphasize the fact that this patient and her children are all fit and perfectly well—April, 1914.

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Case 10.

Man, twenty-six years of age. On February 3, 1911, he had a rapidly acting heart and paroxysmal attacks of breathlessness. The heart dull area was much increased to the left. The apex-beat was 1 inch outside the nipple-line, and in the sixth space. I could not make out any murmur. His pulse was hardly perceptible, and so rapid that it was not countable. On lying down the pulse improved very much, becoming much larger. He had obvious pulsation in the great veins of the neck, and in the liver; but, if he held his breath, the marked venous pulsation in the neck disappeared, and the pulse became small and thready.

He was put on the sugar treatment. In March his heart and pulse improved, the latter going down to about 90, and he was able to walk without being breathless. At the beginning of April he was so much better that, against my wishes, he took on a job as carman. He went on very well for a week or two, when he was rash enough to carry a package of nearly two hundredweight. The next day he became very much worse, and had to go into the hospital, as bad as ever.

April 17, 1911.—He was so ill that he came to see me. Till quite recently he had been an out-patient at the hospital. When he came he was complaining of pain in the abdomen, and his heart was acting so violently and

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rapidly that I could not count his pulse. I told him that he should go into the hospital again. He went, and was admitted on Easter Monday, 1911. He was in the hospital for many weeks, but, although the sugar treatment had done him so much good, they did not give him any sugar while he was in the hospital this time.

About October, 1911, he was made an out-patient again; and finally, in November—as he could not get another "recommend"—he came to me, and he has been on the sugar treatment ever since. He has steadily improved, as the tracings show.

March 28, 1912.—His heart has been quite steady for the last two months, and his pulse never ranges above 70 per minute.

April 14, 1912.—He tells me that he has been digging up ground, and planting potatoes, and sawing wood, since I last saw him a fortnight ago, and that he has not had any unpleasant symptoms. Of course, he was tired after his work, but it must be remembered that he has not done any work for a very long time. His heart was quite steady while he was with me, and he *looked* well.

A short report and tracings of this case appear in Appendix III., B.

Comments on Case 10.

Here again we have the history of sudden strain; not only once, but twice. He got well and went to work; he then lifted a very heavy weight, and his symptoms returned.

It is a case of auricular tachycardia with auricular fibrillation.

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While under treatment as an out-patient at the hospital he had some digitalis, but when he came to me he had cane sugar only.

May, 1914.—This man is now working at extremely heavy work—namely, shovelling tarred stones into a cart—and yet he keeps fit under the cane-sugar treatment.

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Case II.

A young man, twenty-one years of age, without any superfluous flesh on him, came to me in September, 1908, complaining of feeling tired and inability to do his work. For the previous year he "travelled" for his firm, and cycled from town to town all over Devon and Cornwall, with a large bag of books strapped to his back, knapsack fashion.

On examination, I found that his heart was dilated, with its apex-beat well outside the nipple-line. It was acting rapidly and violently, and the apex-beat was obvious on inspection. There was a slight systolic bruit heard at the apex. The pulse was feeble, rapid, and easily compressible. I could not find anything else to call for treatment, so I ordered him complete rest for a couple or three months, and put him on sugar in the usual way. The patient called on me on his return from his rest of two months, and I found that all his symptoms had vanished, he had put on flesh, and was feeling and looking in excellent health.

1914.—He has been quite well ever since, and does his work with pleasure.

I should add that his teeth were very bad, so I ordered them to be seen to by a dentist.

Comments on Case II.

The points here are the rapidity with which the sugar acted, and the fact that he did not take any drugs.

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Case 12.

A lady, thirty-five years of age. The history is that in 1907 she had to give up all work and lie in the recumbent position for several weeks on account of palpitation and frequent faintings, which came on after being put under chloroform for the purpose of having a number of teeth extracted. She got better, and was able to do a little work for the next twelve months, when she suddenly became much worse. As she is an inmate of my house, I called in a medical friend to see her. He thought she was suffering from angina, and treated her accordingly. She improved somewhat, but could do only a little work, so I determined to examine her myself. This was in April, 1910. I found her heart was dilated; but I did not detect any murmur. Her pulse was small, very slow (45), and intermittent. She suffered from severe flatulent dyspepsia, and was living practically on Bovril and milk. She was losing flesh rapidly.

As ordinary treatment had not been of much use, I advised her to try the sugar; but she did not take my advice then, and struggled on till June, 1910, when she got over her scruples, and took about 3 ounces of the sugar daily. Since taking the sugar she has gradually improved, all her symptoms have disappeared, and she is now as strong as a horse, and gets through an enormous

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amount of work—mental as well as physical—and is putting on flesh.

March 22, 1912.—She is in perfect health, and gets through a great amount of work every day. I should add that she has not taken any drugs—only the sugar—since I took her in hand.

May, 1914.—She is still perfectly well, and gets through an enormous amount of work—physical as well as mental.

Comments on Case 12.

As a case of chloroform heart this is worth noting.

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Case 13.

(Given me by a medical friend.)

"Mrs. M. A. E., aged fifty-six. She has suffered from chronic gastritis as long as I can remember. For the last four or five years a cirrhotic degeneration has been going on in her liver. About a year ago she began to fail rapidly, but was under the care of another medical man until four months ago, when she came on the parish and so into my hands.

"On examination, I found all the signs of failing compensation. Previous to this she had not taken any rest unless compelled to do so from exhaustion. With rest and medical treatment, the gradual failing was retarded a bit, but she slowly developed general œdema and anasarca. The heart was now in a shocking condition. The case appeared quite hopeless, and various friends visited her for the last time. It was at this time that I heard from you about the sugar treatment, and I at once put her on 3 ounces daily. Within three days there was a very little improvement, and it was continuous up to the time she left my hands. She has now resumed her daily work of keeping house for three sons, who are labourers, and is able to go long walks without feeling any undue fatigue. The muscle of the heart is seemingly

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quite restored, but of course the jaundice is as bad as ever.

"In this case the patient got nothing but sugar, as when the treatment was started the patient was moribund, and, as it did its work well, I did not see any reason to interfere with the treatment by adding any cardiac tonic."

Comment on Case 13.

The rapidity with which the cane sugar acted is worth noting.

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Case 14.

(Given me by a medical friend.)

"Male, twenty-two years of age. Rheumatic fever six years. Two weeks cough, and short of breath. Anæmic.

"*Heart.*—A.B. sixth space, 1½ inches outside N.L.; C.D. 1 inch to right of sternum.

"*Sounds.*—Systolic at aortic base conducted upwards. No diastolic.

"*Pulse.*—100, feeble. No capillary pulse.

"*Liver.*—Third rib.

"*April* 21, 1911.—Put on 4 ounces of sugar; increased to 5 ounces on April 28.

"*Condition on April* 21, 1911.—Area of cardiac dulness, fourth rib; apex-beat 1 inch out sixth space; systolic murmur still heard; diastolic third left interspace; pulse, 76. Patient got faint on sitting up or moving; pulse became running, and he got short of breath.

"He got steadily better until date of discharge, May 18, 1911.

"*Condition on May* 18, 1911.—Heart, A.B. nipple-line; A.C.D., fourth to fifth rib, not to the right of sternum; pulse steady, 100, full; no shortness of breath or dyspnœa.

"Patient seen one month later. Quite fit. Going to cricket matches, and doing light work.

"During the time he was on the sugar, he was also taking

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tinct. digitalis ℥v., liq. arsen. hydrochl. ℥v., and had been taking it for some time past."

In his letter to me my correspondent adds: "The man never looked back from the time the sugar was started."

Comment on Case 14.

I bring this forward as another instance of auricular fibrillation associated with cardiac dilatation.

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Case 15.

(Given me by a medical friend.)

"Woman, sixty-five years of age, came to me on August 14, 1911, complaining of 'wasting and losing flesh' and general weakness for about a year; complaining also of shortness of breath.

"Her heart dull area extended to the left to outside the nipple-line. Her feet swelled at times. Had only two teeth, and could not masticate her food properly. Pulse extremely feeble and easily compressible. She looked much emaciated, and there was a slight tinge of yellow about her skin.

"I ordered her 3 ounces of sugar daily.

"*August* 28.—She is taking the sugar treatment, and is very much better. Her heart is acting quite regularly. Flatulence ceased. Sleeps well, and can go upstairs much better. Feet do not swell so much.

"*October* 19, 1911.—The old lady is quite well and cheery. She is able to walk fair distances in comfort. Cured, I think."

Comments on Case 15.

The chief point for remark here is the cessation of the trouble from flatulence after taking the sugar for fourteen days.

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Case 16.

Domestic servant, twenty-four years of age. She was admitted to the Royal Devon and Exeter Hospital on March 16, 1911. The following notes I obtained from the hospital:

History. — Sore throat fortnight ago. Pains in back and in joints and arms and legs a week ago. These continued up to time of admission.

Previous Illnesses. — There is a doubtful history of rheumatic fever at the age of twelve years.

Family History.—Nothing to note.

State on Admission.—Complains of pain in the back and in the hip-joints, extending down the back of the thighs to knee-joints. Joints not red nor swollen; no other joints affected now.

Heart.—Apex-beat in the fifth space, 3½ inches to the left of the mid-sternal line. No thrill at apex or base. No definite murmur heard, but the first sound is faint and the second sound booming in character at apex. There is marked accentuation of the pulmonary second sound. The heart's area is not enlarged.

Pulse.—Steady, regular.

Lungs.—Nothing abnormal found.

Abdomen.—Natural.

Urine.—Natural.

March 22.—Much better. Systolic murmur at apex to-

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day, conducted outwards. Second sound at apex shorter and sharper. Great accentuation of pulmonary second sound.

March 29.—Temperature still a little high. No heart murmurs heard at all to-day.

April 5, 1911.—Temperature is normal to-day. (The temperature according to the chart was, on admission, 100·5° F. It then ranged in the neighbourhood of 99·5° F. till April 12, when it went up, and ranged near 100° F. On May 19 it came down, and remained normal for five days, when it became subnormal till June 4; it was then normal for a day or two, and then was subnormal till she left the hospital.—A. G.) Apex-beat is 4 inches to the left of the mid-sternal line. Pulmonary second sound still much accentuated.

The girl remained in the hospital without much benefit till July 5, when she went to Torquay for a fortnight.

(The drug treatment in the hospital consisted of sod. salicyl., salicin, blisters, mesotan, sod. iod., arsenic, quin. ulph. The changes were rung on these till she left the hospital.—A. G.)

August 15, 1911.—She called at my house for advice. She said that Torquay did not benefit her much. Although feeling quite unfit for work, she thought she must try and do something to help her mother and invalid sister. She managed to get a situation, and came to me in the hope that I might be able to advise her how to get stronger.

I found her an anæmic, emaciated girl, complaining of great weakness, breathlessness on slight exertion on

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walking uphill or upstairs. She also complained of pains in all her limbs, loss of appetite, etc.

Heart.—Apex-beat in nipple-line. Dulness extends to right border of sternum. Systolic murmurs at base and apex. Pulsation in the jugulars. Pulse feeble, small, very rapid.

I put her on the sugar. A fortnight later she was much better. On September 12 the improvement was striking. She came and saw me on October 15, when I could not find any murmurs, and the heart dull area was practically normal. She said she could run upstairs, and never felt tired at the end of a hard day's work.

She never came again, but I know that she is keeping quite well, and that she is still (December, 1911) taking the sugar.

March 28, 1912.—I heard to-day that this girl is quite well and going to be married.

Comments on Case 16.

The points in this case which I would emphasize are—(1) Pains of a vague character in many joints, and moving from joint to joint. I notice that it is not uncommon to find that patients with auricular fibrillation suffer in this way, so that it is not surprising to find that this case was mistaken for one of rheumatism. (2) The rapidity of the recovery under the cane-sugar treatment. (3) The return of the heart to its normal size.

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Case 17.

Miss A. B., sixty-three years of age. For the last four or five years this patient has had attacks of pain in the right hypochondrium, associated with jaundice (slight), and dark-coloured urine. In some of the attacks the pain has been extremely severe. She has been treated, and recovered to a certain extent, but she was weaker after each attack.

About six months ago, I put down her attacks to impacted gall-stones. She was losing flesh obviously, and became weaker and weaker.

About four months ago—March, 1910—she consulted me on account of her great weakness and breathlessness. Then, for the first time—I am sorry to say—I thoroughly examined her heart. The heart was somewhat enlarged, and there was a systolic murmur best heard at the apex. Her pulse was 80, feeble, and dropped an occasional beat.

The liver was extremely tender, not only at the epigastrium, but wherever palpable.

I put her on the sugar treatment.

After taking the sugar for a month she was very much better in every way.

About a year afterwards, I was called in to attend her sister. The improved state of my patient was obvious at a glance, and when she trotted upstairs before me, and was not breathless when we got to the top, I could hardly

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believe it. This was on March 20, 1912, and I took the opportunity of examining her. I could not detect any murmur, and the pulse was quite regular, without any dropped beats, and about 60 to 70. She has put on flesh, and she says she feels better than she has done for many years.

Comments on Case 17.

This case is one of a class, and the point to be noted is that I had been treating her for liver trouble pure and simple, whereas the real cause of her trouble—liver or otherwise—was degeneration of the heart muscle, producing auricular fibrillation with its usual train of symptoms, among them being congestion of the liver.

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Case 18.

Miss C. D., twenty-three years of age. Complaining of fainting several times a day, and general weakness, and breathlessness on going upstairs or uphill.

December 16, 1911.—She is very anæmic. Her heart is considerably enlarged to the right, nearly to the right edge of the sternum, and there is a harsh murmur heard over the pulmonary area. There is a thrill at the apex. She has been losing flesh during the last six months. Pulse 90, somewhat irregular, small and feeble. I put her on the sugar treatment.

December 29.—Decidedly better.

February 1, 1912.—She says she is quite well and can do her work with pleasure, and can run upstairs without being more than naturally out of breath, and she recovers from the breathlessness in a few minutes. I cannot detect any murmur, and the heart is not noticeably enlarged. No thrill at apex. Pulse about 70, of good tone.

April 2, 1912.—I have heard that this girl keeps quite well up to now.

Comments on Case 18.

An anæmic case. A large number of anæmic patients with auricular fibrillation get perfectly well under the cane-sugar treatment, and I give this case as an illustration.

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Case 19.

Man, forty-one years of age. Re-admitted to hospital on March 31, 1910. Discharged and made out-patient on August 11, 1910. Complaining of pain in left side of chest.

Previous History.—Patient was previously in the hospital from March 31 to May 28, 1909. History of shortness of breath on exertion. Attacks of severe pain in region of heart lasting from five to thirty minutes.

April 24, 1910.—Patient has had a series of bad attacks during the last forty-eight hours. Amyl nitrite gives no relief. Attacks occur towards evening and during the night.

May 1.—Patient continues to have attacks rather frequently. Pain commences over manubrium sterni and runs down sternum, subsequently following a course to apex of the heart.

May 12.—Patient still has bad attacks; will not react to any of the vaso-dilators. Chloroform inhalations had to be given, which relieve the paroxysms.

June 12.—Has not had so many attacks.

June 20.—Patient has been much better since he was put on pot. iod. mixture; only slight attacks of pain, not requiring chloroform inhalations.

July 1, 1910.—Improvement under pot. iod. continues.

December 8, 1911.—As he could not get another "recommend," he came to me.

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My note on December 8, 1911, is—"This man has paroxysmal tachycardia. His heart is enormously enlarged to the right as well as to the left. The apex-beat is one inch outside the nipple-line. He has strong liver pulsation—obvious both to touch and sight—and also in the veins and great vessels of the neck which is painful to see. The whole chest pulsates, so that his waistcoat is beating as he sits before me. The radial pulse is very feeble, and almost uncountable. He has suffered with his heart for about three years—that is to say, ever since he lifted a heavy sack of oats. An hour after lifting the sack, pains came on in the heart region, and the heart went faster and faster. The rapidity of the heart's action was as distressing to him as the pain. He has not been able to do anything in the way of work since. I put him on 4 ounces of cane sugar daily.

"He has never had rheumatic fever, scarlet fever, nor syphilis. Always been quite healthy up to the time of lifting the sack. He now complains of fluttering of the heart when he walks, and great pains in the heart region; these are so severe as to prevent his doing any work, although he is most anxious to earn his living. When the attacks are on he says that a 'mist comes over his eyes.'"

December 31, 1911.—I think there has been a little free living during Christmastide, with the result that he is not so well. Up to the last time he visited me, December 23, he was steadily improving.

January 7, 1912.—He is much better, and getting over his Christmas excesses. I made his blood-pressure very low, 90 mm. Hg. His fingers were quite white when

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he came in, but gradually assumed their normal redness after he had sat for a few minutes.

April 7, 1912.—From January 7 till now he has been steadily improving. His pulse is 90, still somewhat irregular. His fingers never "go white" now. He has a good hill to walk up to get to my house, but he walks steadily up without any trouble or discomfort. He looks extremely well and is well.

May 20.—For the last month he has been driving a commercial traveller all over our Devonshire lanes, up and down terrific hills. He has been out each day with this "traveller" from eight in the morning till eight at night, and in spite of this his heart is quite steady and he feels well. He now ceased coming to see me.

I should mention that while under my care he did not take any drugs; but he took 4, and sometimes 5, ounces of cane sugar daily, which I provided. He was very poor. He was under me for about four months, and is now able to earn his living if he can get work. It is rarely that he can get a job, as employers are nervous of him.

I did not see him again till I was called to see him late one night in January, 1913. He only had the one room, so I ordered him to the hospital. He was in the hospital for a few days, when he died on January 13, 1913.

I am afraid that he was too poor to provide himself with necessaries, and too proud to apply either to me or others. I cannot help thinking, that if he could have continued the sugar, he would have gone on for a few years more, at all events.

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Comments on Case 19.

This patient did remarkably well while he was under treatment by cane sugar: the chief point, however, is the enormous dilatation of his heart, and the terrible pulsation of the jugulars. It is notable that his heart became quite steady under the treatment, so that he was able to do some work. I feel sure that this man would have gone on for years if he could have restrained his alcoholic propensities. (For tracings of this case, see p. 84.)

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Case 20.

A gentleman, fifty-three years of age, consulted me on May 22, 1912. He had been suffering since the previous November with severe heart symptoms, violent palpitation on the slightest exertion, and extreme breathlessness; and he had been losing weight. He had consulted a well-known London heart specialist, had been put on the customary digitalis treatment, and had spent a couple of months in the South of France, deriving some benefit from the rest and change of climate.

Shortly before the above symptoms became severe (he had suffered from slight breathlessness for some months previously) he had a great shock, being knocked over the edge of a cliff (North Devon) by a horse, while hunting. Luckily he fell into a gorse-bush only a few feet down the cliff, and was able to clamber back without apparent injury; but he dates his severe heart symptoms from that day. After his return from the South of France, he had attacks of tachycardia on April 5 and 20, on May 4, and an extremely prolonged and severe one, confining him to his bed, on May 13, 14, and 15. When he visited me on May 22, he was in a very weak state, and could not walk more than thirty yards without palpitation and breathlessness.

I put him on the sugar treatment. He made immediate and rapid progress. Previous to his illness he had been

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living a very active life in North Devon, hunting several days each week. He was anxious to resume hunting as soon as his improvement permitted, and under my treatment he improved so much that he actually resumed hunting in September, and continued it once or twice a week all through the succeeding winter, being able to spend six or seven hours a day in the saddle.

In April, 1913, I attended him through a severe attack of acute bronchitis. During his illness, which confined him to bed for a fortnight, the regularity and tone of his pulse were extraordinary, and attracted the attention of two other medical men who were called to his case. Throughout this illness he took as much sugar as he could digest, and he made a rapid recovery. I have seen him lately (March, 1914), when he described himself as being in splendid health, and he certainly looked it. He has regained the flesh he lost, and actually weighs half a stone more than he has previously done. He has hunted two days a week throughout the past season (1913-14).

Comments on Case 20.

The points here are—(1) A failing heart made rapidly worse by sudden shock; (2) the wonderful rapidity of the recovery; (3) the peculiar fact that the patient's heart began to fail when beet sugar was substituted for cane sugar, and that it recovered when the cane sugar was again taken instead of the beet sugar.

Some interesting aspects of this case are dealt with in Appendix III., B.

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APPENDIX II.

TRACINGS.

I HAVE given only a few illustrative tracings. Each set of tracings included in a bracket refers to an individual case. In all the cases whose tracings are given cane sugar only has been used as a remedy.

Before giving the tracings, I will quote Dr. Thomas Lewis:

"The value of the arteriogram to the student of the cardiac mechanism can hardly be exaggerated. It forms the foundation of the analysis of irregularities of the heart" (p. 49).

Again, p. 43: "It may be said that the mechanism of the heart may be identified in the majority of cases in which it is irregular by a careful examination of the radial pulse tracing alone."—"Mechanism of the Heart-Beat."

To those of my readers who have only a slight acquaintance with the works of Drs. J. Mackenzie and T. Lewis the following radial tracings from six different cases will explain themselves. To those who are unable to appreciate the tracings I would recommend the study of the works of the two authorities mentioned above.

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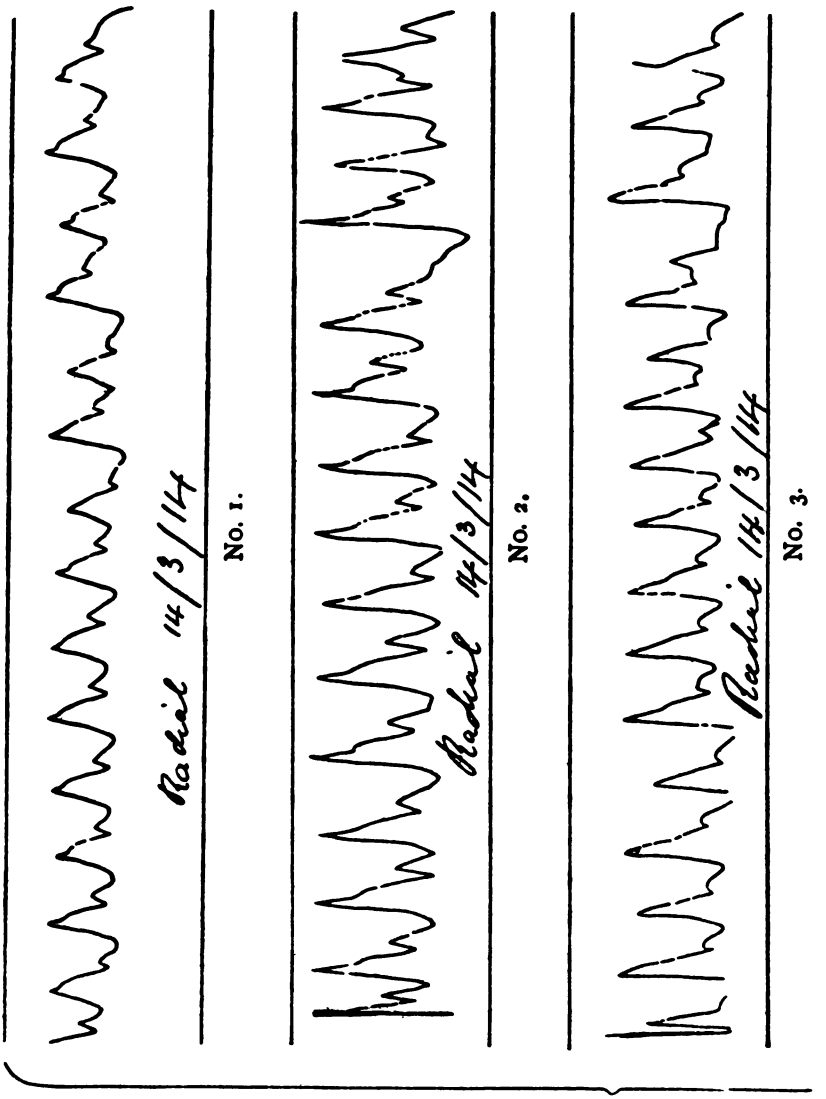

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No. 4.

No. 5.

The tracings 1, 2, 3, 4, 5, are all from the same patient. Tracings 1, 2, and 3 were taken at the first visit, and 4 and 5 at the second visit. I introduce these in order to show the wonderful improvement after about six weeks' treatment. This patient could not walk nor follow his occupation of "author" on account of breathlessness on walking, ascites, œdema of legs, and mental hebetude. He is now (14/7/14) quite well, and "writing" with pleasure, and taking walking exercise daily.

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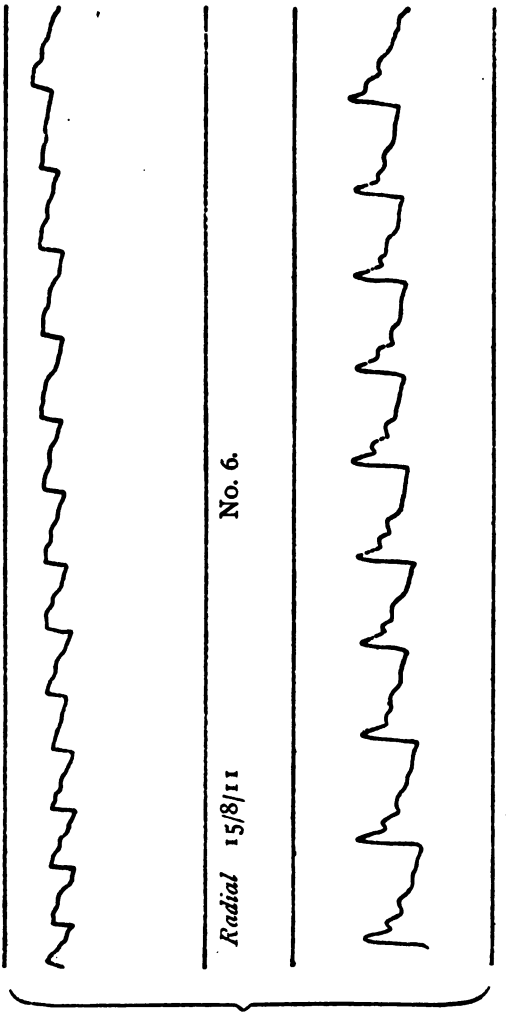

I introduce tracings 6 and 7 as an example of rapid improvement.

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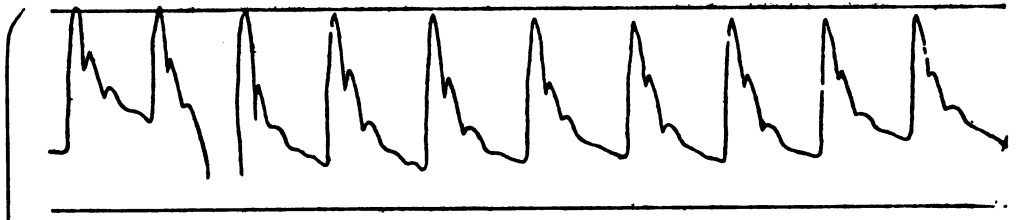

Radial 12/2/12 No. 8.

Radial 4/3/12 No. 9.

Tracings 8 and 9 are illustrative of rapid improvement.

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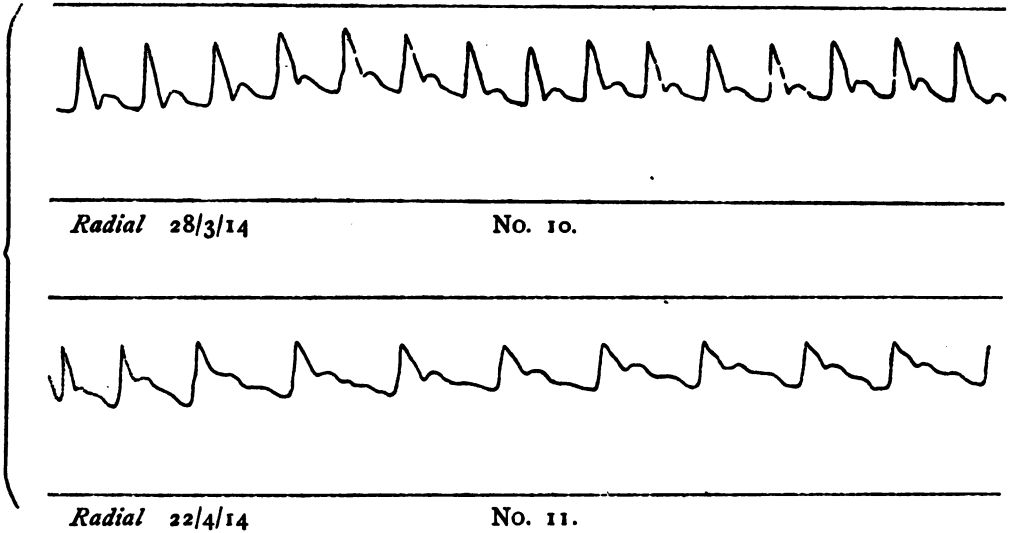

Radial 28/3/14 No. 10.

Radial 22/4/14 No. 11.

Nos. 10 and 11 show rapid improvement in rather less than a month.

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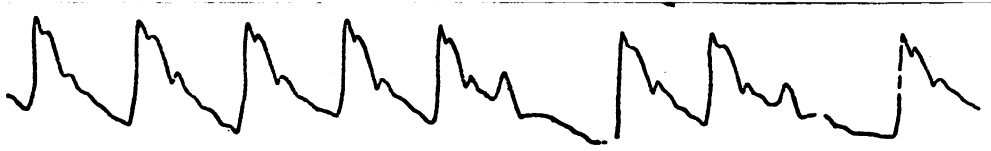

Radial 24/2/13 No. 12.

Radial 24/2/13 No. 13.

Radial 16/5/13 No. 14.

Tracings 12, 13, 14, are all from the same patient, and show the improvement in three months' treatment.

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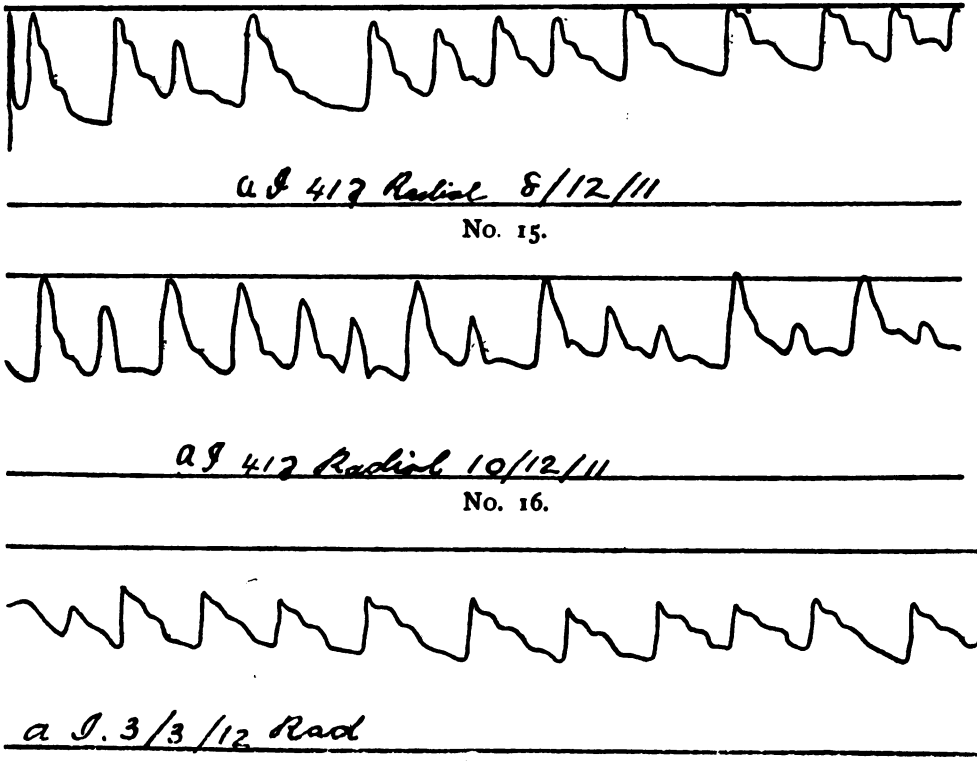

No. 15.

No. 16.

No. 17.

Tracings Nos. 15, 16, 17, are from Case 10 in Appendix I.

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APPENDIX III.

A. An article contributed to the *British Medical Journal* of March 18, 1911.

B. A paper read in the Section of Pharmacology and Therapeutics at the Annual Meeting of the British Medical Association, Liverpool, July, 1912. Appeared in the *British Medical Journal*, September 21, 1912.

C. Extract from the *Times* of December 4, 1912, entitled, STRAIN OF LIFE IN THE GREAT CITIES.

D. Extract from an article in the *British Medical Journal* of February 7, 1914, entitled, HEART DISEASE AND PUBLIC HEALTH.

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A. — A NOTE ON THE BENEFICIAL EFFECT OF THE INGESTION OF CANE SUGAR IN CERTAIN FORMS OF HEART DISEASE.

By A. Goulston, M.A., M.B. Cantab., Heavitree, Exeter.

An article contributed to the *British Medical Journal* of March 18, 1911.

The idea of using sugar for this purpose is somewhat startling until one has thought over the physiology of sugar for a moment. I shall therefore briefly run through the changes undergone by cane sugar from its ingestion to its storage and use in heart muscle.

That glycogen is essential to healthy, well-nourished muscle is shown by the fact that it furnishes a source of energy for the needs of the tissue cells, and particularly for muscular work. The glycogen of a muscle disappears in proportion to the work done by the muscle, and, indeed, prolonged muscular work, especially in starvation, may wipe out quickly the entire store of glycogen in the body —in the liver as well as in the muscles.

All modern physiologists agree that the glycogen stored up in a muscle is converted into dextrose by an amylolytic ferment before being actually used for producing muscular energy. Such a ferment has been discovered by Nasse. In cane sugar, therefore, we have a simple means for supplying the muscles with dextrose for the purposes of their activity.

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All the foregoing is, of course, well-known straightforward physiology, but what is not so generally known, apparently, is that dextrose is capable of nourishing the heart muscle in a most wonderful and peculiar manner. F. S. Locke (King's College, London) has kept the excised mammalian heart beating for ninety-five hours after the death of the animal from which the heart was taken. Perfusion with solution of dextrose was carried out daily for five days, and at the end of that time the heart was beating so regularly that it was used by Professor Halliburton to demonstrate to a class of students. Again, F. S. Locke says: "Experiments have been made with galactose, rhamnose, *l*-arabinose, and glucoheptose. No action at all comparable to that of dextrose could be found."

I have said enough to show the beneficial effect of dextrose on mammalian heart muscle, and in my hands the good effect of taking cane sugar to improve the nutrition of the musculature of the heart has been quite in accordance with what was to be expected from what is known of the physiology of the subject.

I will now very briefly give a few cases illustrating the clinical value of this mode of treatment of certain forms of heart trouble. I should mention that I have always used Glebe granulated cane sugar, which is, I am told, one of the purest cane sugars on the market.

Definition.—I take the physical signs of dilatation given by Broadbent in his work on the heart. The pulse is irregular in rhythm and unequal in force of beat; usually easily compressed. On deep percussion the heart is more

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rounded in the apex region than normal, and the area of dulness is greatly extended to the left. The first sound is short and sharp, and it is almost always audible in the aortic area.

Dilated Heart of Advanced Age.

Lady, seventy-four years of age. Dilated heart with systolic murmur. Treated with drugs with little benefit. She was so ill that she had to be kept in bed in the recumbent position. She was put on cane sugar, and in the course of three months was able to go out walking. She has been quite well ever since, but she takes the sugar from time to time when she feels she requires it. This lady could not stand without feeling faint, but for the last four or five years she has been able to travel alone, visiting her friends. She is now in her eighty-first year, and is quite well, and walks out alone daily.

Gentleman, seventy-seven years of age. In the habit of taking alcohol freely. His heart dilated, and he was losing flesh. All alcohol was stopped, and he was put on the sugar. In three months he was much improved. For the last two years he has enjoyed wonderfully good health. He is rather proud of his achievements in the walking way. Since beginning the sugar treatment he has had an attack of acute bronchitis and one of severe diarrhœa; but he got over both attacks in a wonderful way, and he is now, at eighty years of age, in excellent health, both mentally and physically.

Valvular Heart Disease.

Woman, thirty-four years of age. Admitted to hospital August 18, 1910. August 27, 1910, the note is: "There are very audible systolic and diastolic murmurs at the aortic base." She was treated for three months without benefit, and on December 1, 1910, she was put on the sugar. She has now (January 20, 1911) complete compensation, and her pulse is quite regular and of good tension, and she is assisting in the ward work.

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Woman, twenty-seven years of age. Admitted to hospital October 27, 1910. On November 4, 1910, "the apex-beat is 1 inch outside the nipple-line. Systolic murmur heard all over the chest, and a presystolic murmur at apex." The pulse is hardly perceptible, and her feet, legs, arms, and cheeks are blue (livid). Heart acting extremely feebly. On December 1 she was put on the sugar. On January 5, 1911, she was up and helping in the ward work. She left the hospital January 20, 1911.

For the two previous hospital cases I am indebted to the kindness of Dr. H. Davy, who, on December 1, 1910, allowed me to select them as suitable for the treatment.

Post-Influenzal Dilatation of Heart.

Gentleman, sixty years of age. In September, 1910, he had a sharp attack of influenza, after which his heart dilated with the usual symptoms. He was put on the sugar, and improved rapidly, and has been well ever since.

Heart Strain.

Young man, twenty-one years of age. For some months has been riding all over Devonshire and Cornwall on a bicycle, carrying a heavy load of books on his back. He now complained of feeling weak and unable to do his work. His heart was dilated. I ordered rest, and put him on the sugar. This was two years ago. He is now quite well, and there are no signs of his former trouble. I should mention that he suffered from pyorrhœa alveolaris, and it is possible this had something to do with the dilatation as a contributory cause.

Heart Failure in Tuberculous Phthisis.

Woman, thirty-five years of age. Strong family history of tubercle, from which her father, mother, and brother had died. Eighteen months ago she was extremely thin,

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and had decided symptoms of tuberculous phthisis. The right apex was consolidated, and there was slight expectoration, and she was losing flesh rapidly, and was confined to her bed. I put her on the sugar and Easton's syrup. In the course of six months she improved sufficiently for her to go out of doors for a short walk. Now (January 25, 1911) she can run and do anything in the way of exercise as other people, and she is getting rid of the slatey appearance of her skin, and has a healthy colour. She has put on flesh and retains it. She still takes the sugar, but not in so large quantities. Her heart symptoms have almost disappeared—that is to say, the dull area is only slightly increased to the left, and the apex-beat is nearly in the normal position.

I have had good results also in anæmic cases with dilated hearts, and also in a case of chloroform heart.

In all these cases I have rarely found any sugar in the urine, although so much sugar was taken, but occasionally there was a trace.

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B.—WEST INDIAN CANE SUGAR IN THE TREATMENT OF CERTAIN FORMS OF HEART DISEASE.

By A. Goulston, M.A., M.D., Heavitree, Exeter.

A paper read in the Section of Pharmacology and Therapeutics at the Annual Meeting of the British Medical Association, Liverpool, July, 1912.

[My object in contributing the following paper was to ask some explanation of the curious fact that cane sugar derived from the sugar-cane acts beneficially on the heart musculature where sugar derived from beetroot fails. Chemically, the two sugars are identical; but having the alleged connection of beri-beri and polished rice in my mind, it struck me that there might be an activator in the sugar derived from the sugar-cane which did not exist in the sugar derived from the beetroot.

Assuming for the moment that this is the case, I have thought for some time—and still think—that it is probable that the nearer we get to the ripe sugar-cane (as remedy), the more activator we shall get, because it is possible that some of the activator may be destroyed in the process of refining the raw cane sugar. This idea is, to a great extent, borne out by news lately received from India, where I hear that an officer of the Indian Medical Service is having success in the treatment of heart disease among the poor natives by giving them ripe sugar-cane to chew.—A. G.]

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In this paper I wish to bring before you a suggestion bearing on the treatment of heart disease by means of cane sugar.

In the pages of the *British Medical Journal* there have been brought before the notice of the medical profession —by myself and others—a paper and two cases on the subject of the specific action of cane sugar (West Indian) on the myocardium in auricular fibrillation, which is present, according to Dr. Thomas Lewis and Dr. James Mackenzie, in from 60 to 70 per cent. of all failing, irregular hearts. In the *British Medical Journal* for July 13, 1912, Dr. Thomas Lewis says:

"In 60 to 70 per cent. of all failing hearts, irregularity is the result of a remarkable phenomenon which I described in this journal three years ago—namely, fibrillation of the auricles."

Now, I first brought this specific action of cane sugar (West Indian) on the failing myocardium before the notice of the medical profession generally in a short article I published in the *British Medical Journal* of March 18, 1911. For certain reasons I had to write this article in a great hurry, otherwise I should have mentioned the fact that I had been using cane sugar for these irregular, failing hearts with considerable success for the previous eight or nine years. In consequence of the publication of this little article, two striking cases have been published in the *British Medical Journal*—namely, one by A. H. Carter, M.D. Lond., on November 25, 1911, and the other by Dr. Dingle on January 13, 1912. In my thesis for the degree of M.D. at Cambridge, read May 9, 1912, I established the fact that the ingestion of

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cane sugar has a beneficial effect on the myocardium in certain forms of heart disease. Now, in my hands, and in the hands of my numerous correspondents, this mode of treatment has been eminently successful, and in a large proportion of cases the improvement in the state of the heart and of the patient has been permanent. I have made these preliminary remarks in order to show that the treatment is being made use of by many medical men, and that, therefore, it is to that extent an acknowledged mode of treatment. The sugar treatment is no panacea for diseases of the heart, but it is a valuable addition to our therapeutic armament against failing, irregular hearts.

Given this premiss, I wish to make a suggestion about the mode of action of the temporary excess of dextrose, derived from the ingestion of cane sugar, in the blood—that is to say, does the nutritional value of the dextrose for the myocardium depend on the dextrose alone—as would seem to be the case from Dr. F. S. Locke's experience—or does it depend upon the introduction into the circulation of dextrose *plus* something else? The idea that there might be another factor in the process was aroused in my mind by the following two cases:

1. Lady, seventy-nine years of age, one of my early successful cases. She had given up taking the sugar except in her tea. From my point of view, this means giving up the treatment. In October, 1910, I was called in to see her, and I found her heart irregular again and feeble, and she was feeling ill. I advised her to return to her cane-sugar treatment for a time. I saw her again in a week's time, but there was no improvement. At the end of the next week, as there was still no improvement, I thought I would make a few inquiries. I discovered that she was

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taking beet sugar, and not the sugar made from the sugar-cane—that is, West Indian sugar. I then took means to insure that she took the particular cane sugar which I know to be absolutely pure. At the end of another week the heart was much better, and in a fortnight it was quite regular and the patient had recovered her old feeling of well-being.

2. A gentlemen, fifty-three years of age, consulted me towards the end of May, 1912. I made up my mind that his was a suitable case for the treatment. I put him on it, and he improved rapidly, and after six weeks' treatment he was practically quite recovered and was in his former good health. This patient had to give up hunting on account of his severe heart symptoms, but now he can ride and walk up the stiff hills in North Devon.

He dates the commencement of his heart trouble from about twelve months ago. He struggled on, thinking that his health would improve, until in December last he had to give up hunting, a sport to which he is devoted. Now comes the point I wish to emphasize. When the first bag of pure cane sugar (West Indian) arrived, his wife immediately said, "This is the same kind of sugar we used up to twelve months ago," and, in proof of her statement, she sent for one of the old bags which had been given to the gardener to keep his seeds, etc., in. As I have said, this patient dated the commencement of his heart trouble to about twelve months ago—that is to say, he began to notice that he could not do quite so much as he had been in the habit of doing on account of his breathlessness and palpitation on exertion (even slight), till, finally, he was obliged to give up hunting altogether. Now, directly the ingestion of cane sugar (West Indian) was resumed—under my treatment—he began to mend, and in the course of six weeks became quite well and able to do anything reasonable in the way of walking uphill and riding. When the cane sugar (West Indian) was given up a year ago, beet sugar was used in its place until I put my patient on the cane-sugar (West Indian) treatment.

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Now, in these two cases their hearts failed directly the beet sugar was taken instead of the cane sugar (West Indian), and rapidly improved when the process was reversed and the cane sugar (West Indian) was substituted for the beet sugar.

I naturally ask myself, "Why is this?" I venture to suggest that there is "something" in cane sugar (West Indian) which is not present in beet sugar. What is it? Is it of the nature of a co-enzyme or activator, or what?

Now, I believe I am right in saying that up to the present time cane sugar, regarded from the purely chemical point of view, is cane sugar, whatever its source may be, so I do not get much help from the chemists; but, in spite of this, I ventured to bring my idea to the notice of three of the leaders in the chemical and physiological world, who have given me much help in the past, and they all agree that, although they do not know of anything of the kind, it is not inherently impossible that there may be a factor in cane sugar (West Indian) which is not present in beet sugar. As these physiological and chemical giants did not pooh-pooh my clinical inference, I was able to summon up enough courage to bring the point before your notice as I have now done.

Before closing this part of my paper I should like to mention a curious fact in relation to the feeding of bees, which is interesting in this connection. Practical bee-keepers tell me that it is well known that the syrup used for feeding bees in winter must be made with West Indian sugar, for if it is made with beet sugar the bees deteriorate, and many contract disease and die. Here,

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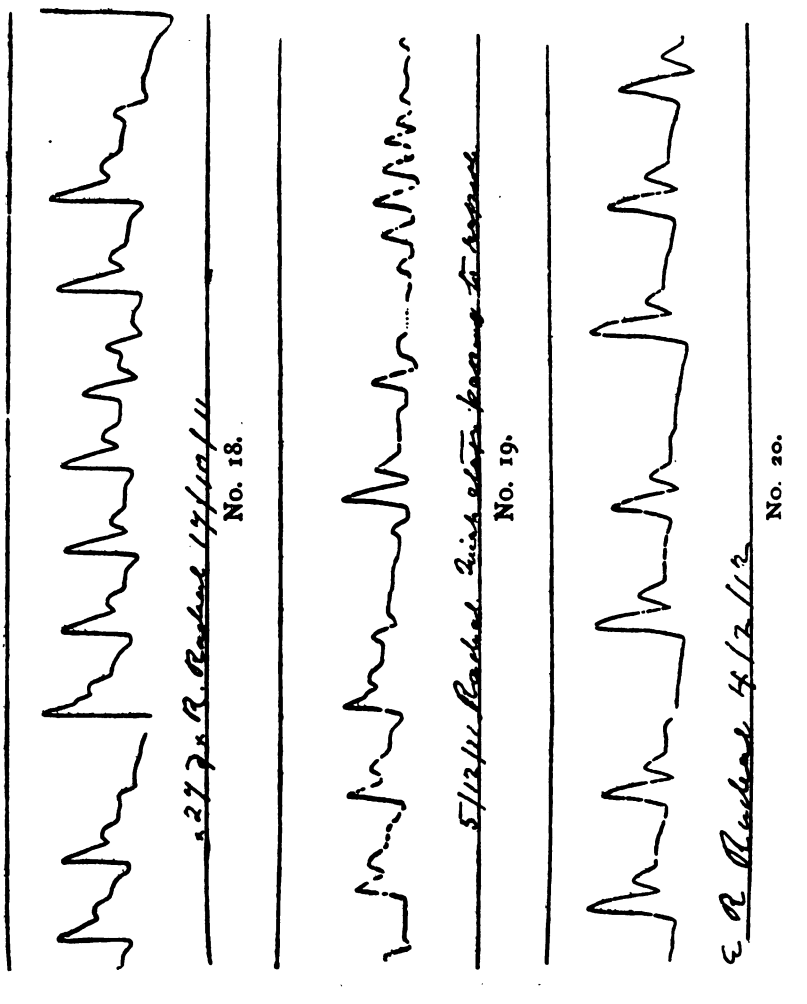

No. 18.

No. 19.

No. 20.

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No. 21.

No. 22.

Tracings Nos. 18, 19, 20, 21, 22, are taken from Case 10, Appendix I.

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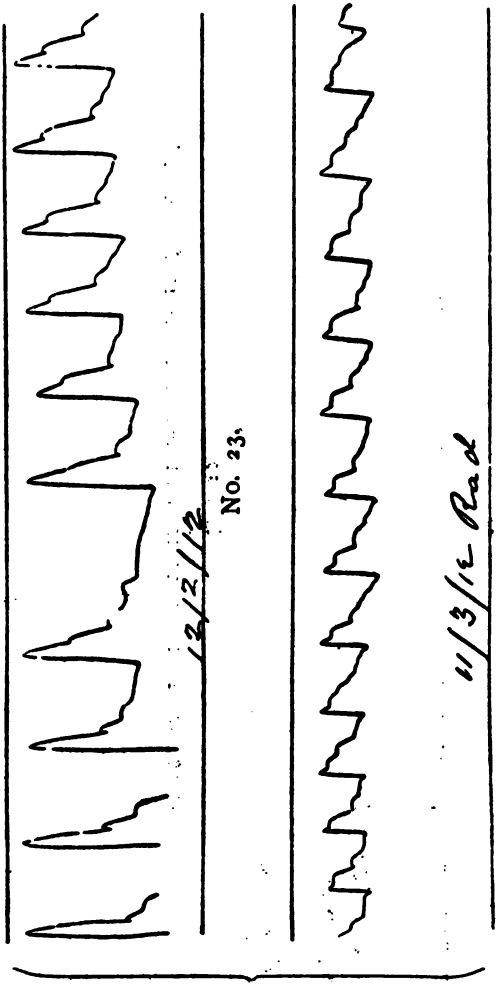

Nos. 23 and 24 illustrate rapid improvement under the treatment.

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again, it would seem that there is something in the West Indian cane sugar which has a beneficial effect on the bees, but which is not present in beet sugar.

The patient from whom Tracings 18 to 22 were taken, a young man of twenty-eight years of age, has been under my cane-sugar treatment since November, 1911. He had been treated in the hospital at Exeter for his paroxysmal tachycardia for rather more than two years before he came to me in November, 1911, but without benefit. He had spent periods of many months in hospital and, when not an in-patient, was treated as an out-patient.

As he could not get another "recommend" for the hospital, he came to me in the middle of November, 1911. I put him on my cane-sugar treatment, and he has steadily improved up to the present time, as will be seen by following the dates of the series of tracings. From the middle of March, 1912, till now (July 24, 1912) he has not had an attack of tachycardia. I saw him on July 21, and he said he was quite well and had not had an attack. Since March, 1912, he had been working at odd jobs, such as felling trees, hedging, and haymaking from 6 a.m. till 9-30 to 10 p.m. All these are hard work, and yet he has not had an attack. Since November, 1911, he has not taken any drugs, but he has taken the cane-sugar treatment the whole time till now, and is still taking it.

In another case there was about a month's treatment between the taking of the two tracings (23 and 24), and I bring these two sets of tracings before your notice to show how rapidly the cane-sugar treatment improves the heart in suitable cases.

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C.—STRAIN OF LIFE IN THE GREAT CITIES.

Extract from the *Times*, December 4, 1912.

The Weakening of the Heart.

The Report of Dr. Newsholme, C.B., Medical Officer to the Local Government Board, for the year 1911-12 was issued yesterday (Cd. 6341).

Speaking generally, the public health during the period covered by the volume has been in a satisfactory condition, and, so far as it can be summarized in terms of reduction of death-rates from all causes and from special diseases, a comparison of the experience of 1911 with the averages of 1891-1900 shows that the rate of infant mortality has declined 16 per cent., the death-rate from measles 13 per cent., from scarlet fever 68 per cent., from whooping-cough 44 per cent., from diphtheria and croup 59 per cent., and from enteric fever 60 per cent. The comparison for the following diseases can only be carried out to the year 1910. Between 1891–1900–1910 the death-rate from puerperal diseases had fallen 70 per cent., from pneumonia 11 per cent., from tuberculosis (all forms) 29 per cent., from pulmonary tuberculosis 27 per cent., and from bronchitis 47 per cent.; while the death-rate from all causes had declined 20 per cent. between 1891–1900–1911. But the

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improvement in the death-rates has not extended beyond the middle of life, the more advanced ages participating in it either scarcely or not at all. A series of figures and tables, taken from the Reports of the Registrar-General, shows for measles, between the periods 1841-1845 and 1906-1910 respectively, a reduction of mortality which reaches a maximum of 64 per cent. between the ages of five and ten, and gradually declines to 3 per cent. between forty-five and fifty-five, changing in the next two decades of life to a rate increased by 9 and 8 per cent. respectively. For females the figures are somewhat better, the decrease of death-rate between the ages of forty-five and fifty-five being still equal to 15 per cent. and a very small decrease continuing till eighty-five is reached, but the gain being greatly less than in the earlier decades.

In considering these figures Dr. Newsholme points out that the increase in the death-rate among men at ages forty-five to fifty-five, when the period 1841-1845 is contrasted with that from 1861-1895 inclusive, and the failure, during the same period, of death-rate in women at the same ages to decline, are facts of great social significance. He dwells upon two sets of circumstances as having been largely instrumental in keeping up the death-rates to an unnecessarily large figure. These are the rapidly increasing aggregation of population in towns, and the associated industrial conditions affecting large masses of population, both male and female.

An inquiry into the causes of this mortality shows that both in men and women *diseases of the heart and blood-vessels were the registered causes of about one-third of*

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*the total deaths in the age period fifty-five to sixty-five,** and that diseases of the respiratory system, including pneumonia, cause in men about one-sixth, in women about one-seventh, of the total deaths at these ages, malignant disease rivalling respiratory diseases as the cause of one-seventh of the total mortality at these ages among men, and one-fifth of that among women. The whole question of cancer is being made the subject of careful and systematic investigation in this and other countries, and the high mortality from diseases of the heart and blood-vessels is in part a consequence of rheumatic fever in earlier life. A large share of it, however, is caused by degenerative changes occurring, at the ages forty-five to fifty-five and fifty-five to sixty-five, which form an important anticipation of senility in the tissues, on whose integrity life and health chiefly depend. Of these changes a general view of the present state of knowledge, by Dr. Andrewes, is given in the Report, and occupies more than fifty pages. It is introductory to an investigation upon which he is at present engaged, and the first results of which are promised for next year.

* The italics are mine.—A. G.

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D. — HEART DISEASE AND PUBLIC HEALTH.

Extract from an article in the *British Medical Journal*, February 7, 1914.

At present measures for the improvement of the general health are to a great extent restricted to a few diseases—the zymotic diseases, tuberculosis, and certain diseases of infants—and Dr. Karl Grassmann has recently done good service by calling attention (*Münch. Med. Woch.*, November 11, 1913) to the fact that there are other fatal and disabling diseases for the prevention of which little or nothing is being done. He instances diseases of the circulatory system, the death-rate from which, in all countries, is high. No collective attempt has yet been made to deal with the matter from a national point of view. In Germany deaths from diseases of the circulatory apparatus at ages from fifteen to thirty years formed 7 per cent., and at the ages between thirty and sixty years 14.5 per cent., of all deaths. In these percentages deaths from apoplexy are not included. Dr. Grassmann states that the Bavarian statistics show that in 1907 nearly 17,000 persons died of diseases of the circulatory organs and of apoplexy, while only 7,000 died of cancer. These two groups of causes of death together account for over one-quarter of the total number. He further points out that serious as is the mortality from these affections, the

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morbidity is still more serious. While it is not possible to form any accurate estimate of the extent of heart disease among the living, some idea may be gleaned from the statistics of persons claiming invalidity benefit under the Workmen's Insurance Laws. Among 151,083 persons who claimed benefit, 13,247 were suffering from some form of heart disease (including apoplexy). Dr. Grassmann says that Dr. James Mackenzie, whom he recognizes as "one of the more experienced heart pathologists and therapeutists," is optimistic in regard to the prognosis of extrasystolic arrhythmia, and E. von Leyden is even more hopeful. It is, he urges, no longer justifiable to take shelter behind the opinion that nothing can be done for the sufferers from heart complaints, though the larger national question is not so much what can be done in an individual case, as what can be done to avoid the incidence of these diseases. Congenital defects are beyond remedy, but while admitting that perhaps some of the acute inflammatory heart diseases cannot be made amenable to preventive measures, Grassmann argues that if the causation of these conditions were properly investigated, and suitable means taken to arrest the development of the cardiac defect, prophylactic treatment might even be extended to them, and that an economic advantage would be gained by the systematized care and relative cure of heart patients before their disease had rendered them a misery to themselves and a burden to the State. One of the primary essentials of any campaign must be earlier diagnosis. New remedies, he thinks, are not wanted, and it may even be possible to do without novel diagnostic

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means; but the diagnostic and therapeutic weapons which we possess must be employed more fully than they are to-day, and the skill of the few in regard to such intricate measurements as are revealed in electro-cardiograms and the like must be fully available everywhere. Institutional treatment and nursing should be supplied at the public expense, since the State will profit by the diminution of unemployment due to ill-health, and by the prolongation of the working life of the individual. . . .

From the quotations given above in Appendix III. (C and D) it is obvious how urgent it is that something should be done to lessen the alarming death-rate from diseases of the circulatory system not only in this country, but also in Germany. In Dr. Karl Grassmann's article in the *Münch. Med. Woch.*, November 11, 1913, pp. 2503-2506, there are many suggestions for combating the scourge, but most of them seem to be extremely costly and of doubtful practical value.

After careful thought I hazard the opinion that, in the matter of diet, if more sugar derived from the sugar-cane and less sugar derived from beetroot were consumed, we should soon find it a satisfactory means of prophylaxis. This thesis, however, is a difficult one to establish with the means at my command; but, with an experience of the ingestion of sugar derived from the sugar-cane, both as a food and as a remedy, extending over thirteen years, I am encouraged to believe that some day it will be proved. —A. G.

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